JUL 8 1927

With METALLURGICAL SUPPLEMENT.

The Engineer.

Established 1856. Registered as a Newspaper.

OFFICE FOR ADVERTISEMENTS & PUBLICATION, 33, NORFOLK ST., STRAND, LONDON, W.C. 2.

VOL. CXLIII.—No. 3728] LONDON: FRIDAY EVENING, JUNE 24, 1927 [PRICE { WITH SUPPLEMENT } ONE SHILLING BY INLAND POST 1s. 3d.

Engineering Library

PUBLIC NOTICES

TENDERS.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Monday, 4th July, 1927, for the SUPPLY of REFRIGERATORS.

Forms for Tender, &c., may be obtained on application to the CONTROLLER of SUPPLIES, H.M. Office of Works, &c., King Charles-street, Westminster, London, S.W. 1. 5757

The Director-General, India Store Department, Branch No. 15, Belvedere Road, Lambeth, S.E.1, invites TENDERS for :—

1. LAMINATED BEARING SPRINGS for ROLLING STOCK.
2. WELDLESS STEEL BUFFERS and SPARE PARTS thereof for ROLLING STOCK.
3. BEARERS, RUBBING BLOCKS, BRACKETS, &c., for RAILWAY WAGONS.

Tenders due on the 5th July, 1927, for No. 1, and on the 8th July, 1927, for Nos. 2 and 3.

Specifications and forms of Tender obtainable from the above at a fee of 5s. per set, which will not be returned. 5782

Assistant Engineers (2) REQUIRED for the KENYA and UGANDA RAILWAY for a tour of 20 to 30 months' service, with possible extension. Salary £480, rising to £720 a year. Free quarters and passages and liberal leave on full salary. Outfit allowance of £30 on first appointment. Candidates, unmarried, 22-28 years of age, must have passed examination to qualify for A.M.I.C.E., or hold equivalent professional qualifications, and have had some experience on Railway Civil Engineering Work.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, London, S.W. 1, quoting at head of application M/15466. 5778

Assistant Engineers (20) REQUIRED for the PUBLIC WORKS DEPARTMENT of the FEDERATED MALAY STATES for four years' service, after which, subject to satisfactory service, the officers appointed will be eligible for confirmation in the permanent and pensionable establishment. It is probable that the number of permanent appointments will be sufficient for those officers whose services have been entirely satisfactory, but no guarantee can be given. If at the end of four years' service an officer's services have been entirely satisfactory and he is not offered or declines further employment, he will be paid a bonus of 2850 dollars. Salary 400 dollars a month, rising to 800 dollars by annual increments of 25 dollars, plus a temporary non-pensionable allowance of 10 per cent. for bachelors and 20 per cent. for married men. The exchange value of the dollar in sterling is at present fixed by the Government at 2s. 4d., but its purchasing power in Malaya is considerably less than that of 2s. 4d. in the United Kingdom. No income tax at present imposed by the Federated Malay States Government. Free passages provided. Candidates, age 23 to 26, preferably unmarried, must have received a good theoretical training, preferably at a University or College recognised by the Institution of Civil Engineers and possess a Civil Engineering Degree or obtained such other diploma or distinction in engineering as the Secretary of State may decide in any particular case or have completed articles with a Civil Engineer of good standing and have passed the examination for Associate Membership of the Institution of Civil Engineers. In addition, candidates must have had at least one year's practical experience of civil engineering under a qualified civil engineer.—Apply at once by letter, giving brief details of qualifications and experience and stating age and whether married or single, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting clearly at the head of application M/15224. 5755

Air Ministry. DIRECTORATE OF SCIENTIFIC RESEARCH.

JUNIOR SCIENTIFIC OFFICER is REQUIRED for the Air Ministry Scientific Research Staff, primarily for duty at the Royal Aircraft Establishment to assist with research work in the Aerodynamics Department.

Candidates should have an Honours Degree in Mechanical or Natural Science, and aeronautical training or experience would be an additional recommendation. Candidates must also be medically fit for flying duties and willing to fly as observer.

Preference given, other things being equal, to ex-Service men. The post will carry superannuation under the Federated Universities Superannuation System. Government contribution being 10 per cent. of mean of scale, individual contribution 5 per cent.

Salary £175, rising by annual increments of £15 to £235, plus Civil Service bonus per annum, giving a present total starting remuneration of £278 19s. per annum.

Application should be made on a form to be obtained from the CHIEF SUPERINTENDENT, Royal Aircraft Establishment, South Farnborough, Hants, to whom it should be returned, quoting reference No. A.180, not later than 16th July, 1927. 5749

Board of Trade. STANDARDS DEPARTMENT.

A VACANCY exists for an ASSISTANT EXAMINER in the Standards Department of the Board of Trade, with establishment in H.M. Civil Service after two years' approved service. The duties are mainly in connection with the control of standards, and with the examination of weighing and measuring apparatus of novel types with a view to their approval for use in trade.

Candidates, who must be British subjects by birth and the sons of fathers also British subjects by birth, should possess a University Degree (or its equivalent) in Science or Engineering and should have had practical workshop experience. Preference will be given to ex-Service men.

The salary is £150, rising by £15 to £300 per annum, with bonus which is re-assessed half-yearly on the basis of the average cost-of-living figure for the previous six months. The present bonus on £150 is £94 14s., making the total remuneration £244 14s.

Applications, with copies of testimonials, should be made in writing to the PRINCIPAL ESTABLISHMENT OFFICER, Board of Trade, Great George-street, Westminster, London, S.W. 1, not later than the 6th July, 1927. 5765

The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.
ARRANGED FOR CARD INDEXING.

Metallurgical Supplement. THE ENGINEER, 24-6-27.

Uniflow Marine Engine with Oil-operated Valve Gear. THE ENGINEER, 24-6-27.

Centenary of the First French Railway. (J. G. H. WARREN.) THE ENGINEER, 24-6-27.

A Critical-Pressure Boiler. THE ENGINEER, 24-6-27.

The Geneva Naval Conference. THE ENGINEER, 24-6-27.

Institution of Electrical Engineers: Summer Meeting—No. II. THE ENGINEER, 24-6-27.

Theory and Practice. THE ENGINEER, 24-6-27.

Centenary of a Waterworks. THE ENGINEER, 24-6-27.

The Rights of Continental Railwaymen to Strike. THE ENGINEER, 24-6-27.

PUBLIC NOTICES

Air Ministry. DIRECTORATE OF TECHNICAL DEVELOPMENT.

A TEST ASSISTANT is REQUIRED in the Metallurgical Department of the Royal Aircraft Establishment. Candidates should hold a Degree in Metallurgy or have had equivalent training and attainments and must have had practical experience in metallurgical work.

Starting salary from 50s. to 60s. plus Civil Service bonus, giving present total remuneration of 83s. 7d. and 97s. 3d. per week, depending upon experience.

Ex-Service man preferred.

Write, quoting A.193 and giving full particulars of age, training, experience and war service, to the CHIEF SUPERINTENDENT, R.A.E., South Farnborough, Hants. 5783

Civil Engineer Required by the GOVERNMENT of CEYLON for appointment as Irrigation Engineer for three years in the first instance. Salary £500, rising to £900 a year by annual increments of £40 (£600 on attaining 30 years of age). Free passages provided. Candidates, unmarried, age 26-31, must have passed the examination to qualify for Associate Membership of the Institution of Civil Engineers or hold equivalent professional qualifications and have had at least three years' practical experience on Waterworks, Drainage or Harbour and Dock Works.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting at head of application M/15465. 5756

Draughtsman Required by the GOVERNMENT of NIGERIA for Railway Survey for a tour of 12 to 18 months' service, with possible extension. Salary £480, rising to £720 a year. Commuted bush and travelling allowance of £9 a month whilst on duty in the Colony. Free passages and camp equipment provided. Outfit allowance of £60 on first appointment. Liberal leave on full salary. Candidates, aged 25 to 40, should have had good training in General Civil Engineering Drawing-office Work.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/15404. 5779

PUBLIC NOTICES

Electrical Engineer Required by the GOVERNMENT of CEYLON for the PUBLIC WORKS DEPARTMENT for a tour of three years in the first instance. Salary £600-40-£1000. Free quarters or an allowance in lieu and passages provided by the Government. Candidates, age 30-45, should be Corporate Members by examination of the Institution of Electrical Engineers and the Institution of Mechanical Engineers and have had good experience in the installation, working and control of electric power supply undertakings, both those equipped with crude oil engines and those with steam turbine generating plant, and in three-phase A.C. distribution from an 11,000-volt supply. Preference will be given to those who have had administrative experience in electric supply undertakings.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, London, quoting M/15384. 5781

The Institution of Structural ENGINEERS.

EXAMINATIONS FOR GRADUATESHIP AND ASSOCIATE-MEMBERSHIP.

The next Examinations for Graduateship and Associate-Membership will take place in London, Bombay, and such other centres as may be arranged on WEDNESDAY, JULY 6th (G), THURSDAY and FRIDAY, JULY 7th and 8th (A/M). Syllabus and form of entry from the undersigned. Closing date for entries, Wednesday, 29th June.

MAURICE G. KIDDY, F.I.S.A., Secretary.
10, Upper Belgrave-street, S.W. 1,
14th June, 1927. 5730

University College of Swansea. The Council of the College invites APPLICATIONS for the POST of ASSISTANT PROFESSOR of METALLURGY. Salary £750 per annum. The appointment will date from the 1st September, 1927.

Further particulars may be obtained from the undersigned, by whom applications must be received on or before the 2nd July, 1927.

EDWIN DREW, Registrar.
Singleton Park, Swansea. 5652

INDEX TO ADVERTISEMENTS, PAGE 101.

PUBLIC NOTICES

The Institution of Structural ENGINEERS.

PUBLICATIONS IN JUNE, 1927.

COMMITTEE REPORT ON STEEL WORK FOR BUILDINGS. PART I., LOADS AND STRESSES. In a Foreword appears a letter from the Clerk to the L.C.C., which states: "... the Report ... contains much that is in accordance with the practice followed at present in the investigation of designs for steel work for buildings submitted for the approval of the London County Council. ..." The price of the Report is three shillings and sixpence.

PART II. of the Report, dealing with STEEL WORK CONNECTIONS: (A) Eccentrically Loaded Rivet Groups; and (B) Connections, Beams to Beams, is also published, price one shilling and sixpence.

REPORT ON LOADS AND STRESSES FOR GANTRY GIRDERS.—The Council of the Institution has also sanctioned the issue of this Committee Report, which is on sale at the price of sixpence.

EXHIBITION OF DESIGNS.

The thirty completed sets of designs submitted in connection with the Brenforce Travelling Scholarship (value £300, awarded in 1927) will be on exhibition at the headquarters of the Institution for a fortnight from and including Monday, 20th June. Members of kindred Institutions who may be interested are invited to view the designs any day between the hours of 11 a.m. and 5 p.m.

MAURICE G. KIDDY, F.I.S.A., Secretary of the Institution.
10, Upper Belgrave-street, S.W. 1,
15th June, 1927. 5744

B.B. & C.I. Railway Company.

The Directors are prepared to receive up to Noon on Friday, 8th July, 1927, TENDERS for the SUPPLY of :—

1. SWITCHES AND CROSSINGS.
2. DOG SPIKES.

Tenders must be made on forms, copies of which, with specification, can be obtained at these offices on payment of 10s. each (which will not be returned).

The Directors do not bind themselves to accept the lowest or any Tender.

S. G. S. YOUNG, Secretary.
Offices: The White Mansion, 91, Petty France, S.W. 1,
20th June, 1927. 5780

Bengal-Nagpur Railway Company, LIMITED.

The Directors are prepared to receive TENDERS for :—

1 ENGINE TURNTABLE, 85ft. in Diameter.

Specification and form of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, London, E.C. 2, on or after 20th June, 1927.

A fee of 10s. will be charged for the specification, which is NOT returnable.

Tenders must be submitted not later than Noon on Thursday, 30th June, 1927.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
R. C. VOLKERS, Secretary.
20th June, 1927. 5758

Borough of Watford. SALE OF WATERWORKS MACHINERY.

The Corporation invites TENDERS for the PURCHASE and REMOVAL of the following MACHINERY and PLANT now situated at the old Waterworks, Local Board-road, Watford :—

LOT NO. 1.

One 40 H.P. Compound Jet Condensing Beam Engine driving 6 Lift Pumps delivering 972 gallons per minute. Manufactured by George Tidcombe and Son, 1878.

And One disused Treadle Lathe with 7in. bed and 7in. centre.

LOT NO. 2.

One 75 H.P. Compound Jet Condensing Beam Engine driving One Bucket and Plunger Pump delivering 1200 gallons per minute against 170ft. head. Designed by E. Easton and Co., Ltd., and manufactured by Messrs. Grimson and Co., 1885 (suitable for re-use).

And One Riveted Steel Air Vessel, 4ft. 6in. by 15ft. Particulars and orders to view may be obtained on application to Mr. W. W. Newman, A.M.I.C.E., F.S.I., Borough Engineer, Municipal Offices, 14, High-street, Watford.

Tenders, in sealed envelopes, endorsed "Tender for Purchase of Machinery," are to be delivered to the undersigned not later than 9 a.m. on Monday, 18th July, 1927.

The Corporation reserves the right to sell the lots separately and does not bind itself to accept the highest or any Tender.

W. HUDSON, Town Clerk.
Municipal Offices,
14, High-street, Watford. 5648

PUBLIC NOTICES (continued) Page 2.
SITUATIONS OPEN, Page 2.
SITUATIONS WANTED, Page 2.
PARTNERSHIPS, Page 2.
AUCTIONS, Pages 3 and 102.
EDUCATIONAL, Page 2.
AGENCIES, Page 2.
MACHINERY, &c., WANTED, Page 2.
FOR HIRE, Page 102.
FOR SALE, Pages 2, 3 and 4.
PATENTS, Page 2.
MISCELLANEOUS, Page 2.
BUSINESSES and PREMISES (For Sale, etc.), Page 102.
WORK WANTED, Page 4.

For Advertisement Rates see Leader Page.

PUBLIC NOTICES

Port of Bristol Authority.

BRUNEL'S LOCK, CUMBERLAND BASIN, BRISTOL.

SINGLE-FACE SLUICE VALVES WITH HYDRAULIC CYLINDERS FOR NEW SLUICEWAY.

The Port of Bristol Authority is prepared to receive TENDERS for SINGLE-FACE SLUICE VALVES with HYDRAULIC CYLINDERS for NEW SLUICEWAY at Brunel's Lock, Cumberland Basin, Bristol.

On and after Monday, the 27th June, 1927, copies of the specification and contract drawings can be obtained from the undersigned on production of a receipt showing that a deposit of £3 has been paid. ALL CHEQUES MUST BE MADE PAYABLE TO THE "PORT OF BRISTOL AUTHORITY" and forwarded to the General Manager and Secretary, Docks Office, 19, Queen-square, Bristol. The deposit will be returned to bona fide tenderers after the receipt of the Tender with all the prescribed documents and drawings.

Tenders must be enclosed in a sealed envelope, endorsed "Tender for Sluice Valves, Cumberland Basin, Bristol," addressed to the General Manager and Secretary of the Port of Bristol Authority, 19, Queen-square, Bristol, and must be delivered to him, accompanied by all the prescribed documents and drawings, before 10 a.m. on Monday, the 11th day of July, 1927.

The Port of Bristol Authority does not bind itself to accept the lowest or any Tender.

THOMAS A. PEACE,
Chief Engineer.

Chief Engineer's Office,
Avonmouth Docks, Bristol,
24th June, 1927. 5785

Singapore Municipality.

ST. JAMES'S POWER STATION.—FIRST EXTENSION.

The Municipal Commissioners of the Town of Singapore invite TENDERS for the SUPPLY, DELIVERY, and ERECTION in Singapore of ONE 10,000 K.W. TURBO-ALTERNATOR and CONDENSING PLANT.

Specifications may be obtained on and after Friday, the 24th inst., from Messrs. Preece, Cardew and Rider, 8, Queen Anne's-gate, Westminster, S.W. 1, on payment of a deposit of £2 for each copy, which will be refunded on receipt of a bona fide Tender. Extra copies may be purchased at 10s. each.

Sealed Tenders, in duplicate, endorsed "Singapore—Turbo-alternator," are to be delivered to the Agents of the Singapore Municipality, Messrs. PEIRCE and WILLIAMS, 64, Victoria-street, Westminster, S.W. 1, on or before Noon on Monday, the 25th July, 1927.

The Municipal Commissioners do not undertake to accept the lowest or any Tender. 5751

PUBLIC NOTICE.

Bombay Municipality.

APPLICATIONS are INVITED for the POST of the DEPUTY EXECUTIVE ENGINEER, DRAINAGE, on a salary of Rs. 1200-50-1500 per mensem, plus conveyance allowance in accordance with the rules of the Corporation.

The post is at present a supernumerary one, but the selected candidate will be confirmed in the post on the 1st April, 1928, or after such period of probation not exceeding 6 months in all, as may be considered necessary.

Applicants must have been regularly trained as Civil Engineers, particularly in Sanitary Engineering, and should have had preferably about 10 years' practical experience in Civil Engineering. They must have administrative ability and good and sound knowledge and experience in designing, estimating, supervising and maintaining large Drainage and Sewerage Works. They must be Corporate Members of the Institution of Civil Engineers (England) or the Institution of Engineers (India), or must hold the Testamur of the Institution of Municipal and County Engineers, or must be Graduates in Civil Engineering of any recognised European, American, or Indian University.

Applications, stating age, training and qualifications, with copies of not more than three testimonials and two references, should be addressed to the Municipal Commissioner for the City of Bombay, and should reach him not later than 31st August, 1927.

The successful candidate will be entitled to the benefit of the Leave Rules and Provident Fund Rules applicable to Municipal Servants for the time being in force.

Employees in Bombay municipal service are not debarred from applying for the post, but such applications should be made through the heads of their respective Departments.

H. B. CLAYTON,
Municipal Commissioner for the City of Bombay.
Municipal Offices, Bombay,
20th May, 1927. 5683

City of Bradford.

The Sewage Committee of the Bradford Corporation are contemplating the APPOINTMENT of a SUPERVISOR of their Sulphuric Acid Plant.

Persons desirous of being considered should write to the undersigned, stating (1) their experience in operating Mills-Packard Chamber Plants in combination with Harris Furnaces burning pyrites, and (2) salary required, before 2nd July, 1927.

H. WONTNER SMITH,
Sewage Works Engineer.
Esholt Hall, near Shipley. 5791

Punjab Public Works Department.

HYDRO-ELECTRIC BRANCH.

APPLICATIONS are INVITED from candidates to fill an APPOINTMENT (the formal creation of which is at present under contemplation) of a "SALES-ENGINEER" of rank equivalent to that of an Executive Engineer in the Indian Service of Engineers. He will be required to take charge of all commercial business connected with negotiations for the sale of hydro-electric power.

For further particulars apply to:—
W. N. McLEOD, Esq., B.Sc., I.S.E.,
Superintending Engineer,
Administration Circle, P.W.D.,
Hydro-electric Branch,
Benmore Simla-E.

Applications will be received up to 10 a.m. on August the 1st, 1927. 5661

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, WORKS MANAGER for Large Iron and Steel Works. Must be capable organiser and have complete knowledge of Engineering and Manufacture.—Address, with full particulars of experience, age, and salary desired, P3293, The Engineer Office. P3293 A

ADVERTISEMENT CANVASSER REQUIRED by well-known Electrical Engineering Journal. Good knowledge of the trade and some advertising experience is essential. Age should not exceed 35.—Address, giving full particulars of previous experience to P3340, The Engineer Office. P3340 A

ENGINEER SALESMAN, Age 25 to 30, REQUIRED in London. Permanent position with excellent opportunities. A gentleman of good education required to devote his time to the sale of Boiler House Specialties, such as Superheaters, CO2 Recorders, Steam Meters and the like. None need apply except those of proved ability as salesmen and who have qualities of enterprise, energy and persistence.—Apply by letter only, giving age, experience and salary required, to JAMES GORDON, Esq., Windsor House, Kingsway, London, W.C. 2. 5762 A

ENERGETIC REPRESENTATIVE REQUIRED by well-known firm of Machine Tool Dealers, to Travel for Small Tools and Machine Tools; previous experience necessary. Must have own car. Salary and commission.—Write, stating experience and enclose copy of references, Box 441, Dorland's, 14, Regent-street, S.W. 1. P3333 A

LARGE and Old-established Firm of MECHANICAL ENGINEERS in India REQUIRE a MACHINERY SALESMAN, age not over 24, unmarried, of good education and address and fully trained in Steam and Oil Engines,—Reply, giving fullest details education, engineering experience, present work and salary, to "Z.M. 545," care of Deacon's Advertising Agency, Fenchurch avenue, London, E.C. 3. 5766 A

REQUIRED, a QUALIFIED MECHANICAL and ELECTRICAL ENGINEER, to undertake the lay-out of a plant for Boiler House, Electric Power, Steam Heating, Electric Lighting, Lifts, &c., and with good knowledge of the building trade—a real hustler required, who will make himself indispensable to a large building contractor. Age 35-45.—Address, stating salary and past experience, P3354, The Engineer Office. P3354 A

LABORATORY ASSISTANT.

REQUIRED by Scientific Institution in South London, YOUNG MAN, to Assist in Workshop and Experimental Work. Must possess good education up to matriculation standard and about two years' sound practical experience.—Address, 5796, The Engineer Office. 5796 A

SPANISH COMMERCIAL and TECHNICAL TRANSLATIONS, Daily Correspondence undertaken, 10s. per hour, including typing, not stationery.—Write, Z.A. 534, care Deacon's, Fenchurch-avenue, E.C. 3. 5768 A

YOUNG ENGINEERS WANTED in Midland District. Several first-class men with drawing-office and shop experience.—Address, giving full particulars, 5792, The Engineer Office. 5792 A

WANTED, a DRAUGHTSMAN, Experienced in Light Internal Combustion Engines, preferably with Railway Experience. State age and experience.—Address, 5772, The Engineer Office. 5772 A

WANTED, for the North-East Coast, TWO DRAUGHTSMEN for Oil Engine Detail Development Work. Thorough knowledge of Oil Engines essential.—Address applications, stating experience and salary required, 5703, The Engineer Office. 5703 A

WANTED, by Locomotive Works, North-East Coast district, good LEADING DRAUGHTSMAN; also TWO good DRAUGHTSMEN with Shop Experience. One of the latter will be required as responsible Locomotive Estimator, and must be capable of Taking Charge of the Estimates in the absence of Chief Estimator. State age, previous experience and salary required.—Address, 5773, The Engineer Office. 5773 A

WANTED, Capable Young DRAUGHTSMAN as Junior Assistant to Naval Architect.—Apply, stating age, training and other qualifications, to Messrs. J. SAMUEL WHITE and CO., Ltd., East Cowes, I. of W. 5760 A

WANTED, DRAUGHTSMAN; also JUNIOR. Experienced in Oil Engine Details; 30 miles from London.—Address, stating age, experience and salary required, 5754, The Engineer Office. 5754 A

WANTED, DRAUGHTSMAN (DESIGNER), Structural Engineers' Office; must be thoroughly capable; good salary to suitable man.—Address, 5759, The Engineer Office. 5759 A

WANTED, for the Midlands, DRAUGHTSMAN, accustomed to first-class Railway Carriage Bodywork; also, if possible, experience in all type of Wagons.—Address, 5771, The Engineer Office. 5771 A

WANTED, SEVERAL Good MECHANICAL DRAUGHTSMEN, accustomed to good-class work.—Apply, stating age, experience, and salary required, VICKERS Ltd., River Don Works, Sheffield. 5784 A

CONSTRUCTIONAL ENGINEERS REQUIRE DETAILING DRAUGHTSMAN; must be experienced in London Structures and be quick and accurate.—Address, with particulars, age, experience, &c., 5763, The Engineer Office. 5763 A

DESIGNING DRAUGHTSMAN REQUIRED by London Constructional Engineers; used to working under London Building Acts, and able to design economically.—Address particulars, experience, age, &c., 5764, The Engineer Office. 5764 A

EXPERIENCED DRAUGHTSMAN REQUIRED for temporary position; accustomed to the Designing of Girder Work and other Constructional Work, Measuring-up existing Bridges, Calculation of Stresses, &c.—Apply by letter to the DIVISIONAL ENGINEER, Engineer's Office, L.M. & S. Rly., Crewe, stating age, experience and salary required. 5753 A

JUNIOR DRAUGHTSMAN REQUIRED by Well-known firm in the Midlands; must have good experience in Electric Cranes and Lifts. Applicants are requested to state experience and salary required.—Address, 5774, The Engineer Office. 5774 A

YOUNG Capable DESIGNER REQUIRED with sound experience of Modern Screwing Machine Design, to eventually Take Complete Charge.—Address, 5795, The Engineer Office. 5795 A

SITUATIONS WANTED

BUYER, Engineering Materials and General Stores, thoroughly acquainted direct sources of supply, DESIRES POSITION; keen organiser.—Write, Z.C. 538, Deacon s, Fenchurch-avenue, E.C. 5769 B

CIVIL ENGINEER, aged 36, Fully Qualified, shortly disengaged, REQUIRES POSITION as Contractor's Engineer Agent or Resident Engineer; experience England, Singapore, British Guiana, North China and Venezuela in docks, main drainage, roads, buildings. Good organiser and energetic.—Address, P3329, The Engineer Office. P3329 B

CIVIL ENGINEERING ASST. (24), WANTS POST in England. University training, 4 yrs. shops, 18 mths. D.O., 6 mths. on construction. Speaks French and Spanish.—Address, P3351, The Engineer Office. P3351 B

ENGINEER of Exceptionally Wide Experience, used to full control of commercial, drawing-office and works staffs, DESIRES POSITION as GENERAL MANAGER works, 1000/5000 men. Highest references. Administrative and production efficiency. Would accept part remuneration on results.—Address, P3292, The Engineer Office. P3292 B

ENGINEER (40) SEEKS APP.; 14 Years' with Same Firm as Chief Outdoor Engineer for Inspection, Supervising, Erection, Starting and Testing. Excellent refs.—Address, P3339, The Engineer Office. P3339 B

ENGINEER (41), Experienced Mine and Quarry Plant, Maintenance or Erecting, or as REPRESENTATIVE for firm selling MACHINERY, CASTINGS, or ENGINEERING COMMODITIES.—Address, P3352, The Engineer Office. P3352 B

ENGINEER, Steam and Oil, Home or Abroad. Contracted British and Native Labour, West Indies, or would REPRESENT; 25, Public School.—Address, P3345, The Engineer Office. P3345 B

FURNACE Builder and Assistant Furnace Manager, with 10 years' experience, DESIRES POSITION as FURNACE MANAGER. Can take control of all kinds of Gas Continuous Mill and Coal Furnaces; also Gas Producers.—Address, P3347, The Engineer Office. P3347 B

SITUATIONS WANTED (continued)

INDIA OR FAR EAST.—SALES MANAGER, Engineering and Mechanical Goods; just returned after 6½ years in India, valuable connections, OPEN for ENGAGEMENT as Sole Representative or Sales Manager to established business house.—Address, P3338, The Engineer Office. P3338 B

HONS. B.Sc. (23), Two Years on Outside Work with public works contractors only, DESIRES POSITION, preferably in drawing-office of Structural Engineers or similar.—Address, P3343, The Engineer Office. P3343 B

MANAGER, General or Works, DESIRES POSITION. First class credentials for up-to-date works organisation. English and Continental experience.—Address, P3342, The Engineer Office. P3342 B

OIL.—YOUNG ENGINEER, Age 25, Completing 3 years' contract with important Oil Co. in the East, free in September, DESIRES CHANGE. Shop and drawing-office experience in oil refining, design and lay out of plant, marine and general engineering.—Address, P3322, The Engineer Office. P3322 B

POSITION WANTED as RESIDENT ENGINEER, Docks, Railways, Roads, Bridges.—Address, 5797, The Engineer Office. 5797 B

YOUNG ENGINEER (28) SEEKS APP.; ex-Public school and tech. training, shops, 3 years D.O. and 2 years asst. eng.; excellent testimonials.—Address, P3335, The Engineer Office. P3335 B

DRAUGHTSMAN, Age 24, REQUIRES SITUATION. 7 years' experience in design of elevators and conveyors, good detailer and tracer.—Apply WARREN, 13, Chestnut Walk, Harebreaks, Watford, Herts. P3349 B

DRAUGHTSMAN, 12 Years' Experience in General Mechanical, Electrical Engineering, including general engineering training, REQUIRES SPARE TIME WORK. Lay-outs, detail drawings, and tracings made.—Address, P3341, The Engineer Office. P3341 B

DRAUGHTSMAN, 22 Yrs. Experience. Factory lay-outs and maintenance, chemical and rubber plants, conveyors and elevators, pipe work, structural steelwork. Good references.—Address, P3346, The Engineer Office. P3346 B

YOUNG MAN (23), with Examinations in Mech. and elec. eng. and mech. technology, DESIRES POST as Junior Draughtsman; willing to accept small salary to start.—A. WICKHAM, 106A, Broughton-road, Fulham. P3330 B

MACHINE SHOP FOREMAN, Disengaged, REQUIRES SITUATION; 18 years machine shop foreman, motor, machine tool, electrical, general and constructional; alive and first-class ability; age 39.—Address, P3334, The Engineer Office. P3334 B

PARTNERSHIPS

IF YOU ARE SEEKING

A PARTNER or PARTNERSHIP

or wish to buy or sell a

BUSINESS or WORKS

Write:

WHEATLEY KIRK, PRICE & CO.,
46, Watling Street,
London, E.C. 4.
Established over 75 years.

If you wish to purchase or sell a Business connected with the Engineering or allied Industries consult:

HENRY BUTCHER, HALL & CO.,
63 & 64, CHANCERY LANE,
LONDON, W.C. 2.

AGENCIES

ADVERTISER, with World-wide Selling Experience, presently working large established connection M.S. Bars, Sections, Plates, Sheets, &c., amongst principal Engineering and Allied Trades Firms, SEEKS another good NON-COMPETING FIRM. Southern Midlands and East Anglia. Pt. Exs. and Com. basis. Own car. Highest testimonials.—Address, P3344, The Engineer Office. P3344 D

ADVERTISER, with 20 Years' Practical Experience in Structural and General Engineering, and Contracting, all departments, good connection throughout the Irish Free State, WISHES to get in touch with strong firm desiring REPRESENTATION in that country. Excellent testimonials and references; first-class salesman, or would take up SUITABLE POSITION in any part of the British Isles.—Address, P3348, The Engineer Office. P3348 D

AUSTRALIAN ENGINEER, M.I. Mech. E., with 20 years' technical and commercial experience, big connection power-houses and collieries, DESIRES REPRESENTATIONS in Australia, well-established Engineering Firms.—Address, P3306, The Engineer Office. P3306 D

HIGH-SPEED STEEL and TOOLS; Liberal terms offered anyone introducing business or connection.—Address, P3180, The Engineer Office. P3180 D

MIDLANDS FIRM of Technical Engineers REQUIRE additional REPRESENTATION for a competitive leading Manufacturer of Wire Ropes, Pit Tubs, or similar productions, used by collieries and ironworks, or plant of interest to large steam users. Only first-rate proposals entertained for progressive business.—Address, 5793, The Engineer Office. 5793 D

EDUCATIONAL

CORRESPONDENCE COURSES for Inst. Civil Engineers, Inst. Mech. E., London Univ., and ALL ENGINEERING EXAMINATIONS, personally conducted by Mr. TREVOR W. PHILLIPS, B.Sc. (Honours), Eng., London, Assoc. M. Inst. C.E., Chartered Civil Engineer, M.R.S.I., F.R.S.A., &c. Excellent results at all Exams., comprising hundreds of successes. Courses may commence at any time.—Apply to Mr. TREVOR W. PHILLIPS, B.Sc. (Hons.), A.M.I.C.E., &c., 8/11, TRAFFORD CHAMBERS, 58, SOUTH JOHN-STREET, LIVERPOOL. Tel. No., Bank 1118.—London Office: 65, Chancery-lane, W.C. 2. Ex. B

MISCELLANEOUS

ENGINEERS—Here is Your Opportunity! The A.M.I. Mech. E., A.M.I.A.E., or A.M.I.E.E. qualification is a certain passport to a responsible post. Our free 64-pp. book "Engineers' Guide to Success" will show you how to obtain any engineering qualification easily. 40 Engineering Diploma Courses also described. Write now, stating branch or exam. which interests you, to TECHNOLOGICAL INSTITUTE, 76, Thanet House, 231, Strand, London. P3284 I

PATENTS

BRITISH PATENT No. 265,896, "'Jolo' Improved Flexible Belt Fastener," FOR SALE.—NORSK REMLAASFABRIK "JOLO," Bergen, Norway. P3318 B

KING'S PATENT AGENCY, Ltd. (Director, B. T. KING, C.I.M.E., Registered Patent Agent, G.B., U.S., and Canada). Inventions advice handbook and consultations free.—146a, Queen Victoria-street, London, E.C. 4. 40 years' refs. 'Phone: Central 0682. 5087 B

THE PROPRIETOR of BRITISH PATENT No. 203,769, dated 12th June, 1922, relating to "Improvements in Liquid Level Indicators," is DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or otherwise EXPLOITING the above patent and ensuring its practical working in Great Britain.—Inquiries to Mr. B. SINGER, Steger Building, Chicago, Ill., U.S.A. 5694 B

THE PROPRIETOR of BRITISH PATENT No. 219,274, dated July 19th, 1923, relating to "Tool for Cutting and Removing Pipe from Wells," is DESIROUS of ENTERING into ARRANGEMENTS by way of a LICENCE or OTHERWISE on reasonable terms for the purpose of exploiting the above patent and ensuring its practical working in Great Britain. All inquiries to be addressed to B. SINGER, 28, East Jackson-blvd., Chicago, Illinois. 5777 B

THE PROPRIETORS of BRITISH LETTERS PATENT No. 222,425, relating to "Submarine Signalling Apparatus," are DESIROUS of ENTERING into NEGOTIATIONS with interested parties with a view to the EXPLOITATION of the INVENTION, either by SALE of the PATENT RIGHTS or by the GRANTING of LICENCES on reasonable terms.—All inquiries should be addressed to WM. BROOKES and SON, Chartered Patent Agents, 5, Chancery-lane, London, W.C. 2. P3332 B

TO COALOWNERS AND MANUFACTURERS OF BRIQUETTES. — The PROPRIETOR of PATENTS Nos. 217,236 and 219,659 is DESIROUS of ENTERING into NEGOTIATIONS for the GRANT of LICENCES on royalty or otherwise, or to treat for the SALE of the PATENTS outright.—Particulars will be furnished on application by A. M. and WM. CLARK, 53 and 54, Chancery-lane, London, W.C. 2. 5642 B

MACHINERY, &c., WANTED

WANTED.—ONE Cambridge and Paul 2-Point Thread RECORDING PYROMETER; indicator, range 0 to 1000 or 1200 deg. C.

ONE Cambridge and Paul pivoted type WALL PATTERN INDICATOR, 0 to 1000 or 1200 deg. C. Base metal plain stem type. Thermo-couples must be in good condition and in working order.

State where can be seen.

Address, 5775, The Engineer Office. 5775 F

WANTED, SEVERAL 4 to 5-TON LOCO. CRANES, recent manufacture.—JOSEPH PUGSLEY and SONS, Ltd., Lawrence Hill, Bristol. 5790 F

WANTED, TWO LANCASHIRE BOILERS, Practically new, 24ft. by 6ft. 6in., insured at 100 lb., complete with all fittings and furnaces.—Address offers, giving fullest particulars and specifications, P3331, The Engineer Office. P3331 F

WANTED, 120 10-TON LOW DROP SIDE WAGONS, standard gauge, for ballast; also FOUR PAIRS of 10-TON TIMBER BOGIES with Bolsters.

JOSEPH PUGSLEY and SONS, Ltd., Lawrence Hill, Bristol. 5789 F

GAS ENGINE WANTED, 250/350 H.P., 200 R.P.M., suitable for running on producer gas.—Address, 5716, The Engineer Office. 5716 F

FOR SALE

BOILERS, &c., DELVERED FROM STOCK, subject to being unsold:—

New 30ft. by 7ft. 6in. LANCS., 180 lb. W.P.

New 11ft. by 5ft. CYL. TANKS or RECEIVERS, 80 lb. W.P.

New 10ft. by 4ft. 6in. AIR RECEIVER, 100 lb. W.P.

R. and T. DANKS (NETHERTON), Ltd., Netherton, Dudley. 5090 G

ELECTRIC GENERATING SETS FOR SALE.—

TWO	120 K.W.,	230 Volts,	D.C.	
TWO	150 K.W.,	500 volts,	50 cycles,	3-phase.
TWO	185 ,,	500 ,,	,,	,,
TWO	200 ,,	440 ,,	D.C.	
ONE	300 ,,	230 ,,	,,	
ONE	350 ,,	400 ,,	50 cycles,	3-phase.
ONE	400 ,,	220 ,,	D.C.	
ONE	500 ,,	3300 ,,	50 cycles,	3-phase
ONE	500 ,,	500 ,,	D.C.	
TWO	500 ,,	525 ,,	50 cycles,	3-phase.
TWO	750 ,,	3300 ,,	,,	,,
ONE	800 ,,	525 ,,	,,	,,
ONE	850 ,,	460 ,,	D.C.	
ONE	1000 ,,	6600 ,,	50 cycles,	3-phase.
ONE	1500 ,,	3300 ,,	,,	,,
ONE	5000 ,,	6600 ,,	,,	,,

All above plant of modern construction and sound in every way.

THE PHŒNIX ELECTRICAL CO., Ltd., 18, Scotland-street, Glasgow. 5770 G

FOR IMMEDIATE SALE.—ONE High-class ENGINEERS' PLANING MACHINE, to plane 12ft. 6in. by 7ft. 3in. by 5ft. high, three tool-boxes, for angular slides; a powerful tool.

ONE SET Equal New 3-THROW HORIZONTAL HYDRAULIC PUMPS, 3in. ram, 6in. stroke, 1500 lb. pressure, for motor drive.

LARGE STOCK of SHIPYARD and STEEL WORKS PLANT, MACHINE TOOLS, &c.

SEND US YOUR ENQUIRIES.

JOHN H. RIDDEL, Ltd., 40, St. Enoch-square, Glasgow.

FOR SALE.

A LARGE SELECTION OF HIGH CLASS MACHINE TOOLS, including Lathes, Planing, Milling, Drilling, Grinding, Slotting and Gear Cutting Machines, by the best makers.

Inquiries invited.

MATTHEW WHYTE & SONS,
15, CLYDE PLACE, GLASGOW, S.S. Ex

FOR SALE.

FOUR New "Emperor" BRIQUETTING PRESSES, by Sutcliffe, Speakman and Co., Ltd., suitable for making lime sand and concrete bricks, also from clays adaptable for the semi-dry process; also for briquetting mineral ores, coal, coke, &c. Pressure exerted is 150 tons and has a capacity of 1500 briquettes per hour, requiring 10/12 H.P. to drive. Designed for making briquettes about 6½in. by 6½in. by 3in.

ONE 5-Ton Butters ELECTRIC SCOTCH DERRICK CRANE, 70ft. steel jib, timber mast and sleepers, 20 H.P. Electric Motor, by J. P. Hall, of Oldham; 410 volts, 50 amps., 675 revs., D.C.

CAST IRON SECTIONAL TANK, 24ft. by 20ft. by 8ft. deep, formed of plates 4ft. sq., capacity about 22,750 gallons. Lying at Chepstow. Very low price will be accepted to avoid bringing into stock.

GEO. COHEN, SONS AND CO. LTD.,
600, COMMERCIAL-ROAD EAST,
LONDON, E. 14. Ex.

For continuation of For Sale Advertisements see page 3.

A Seven-Day Journal

A Fine Flying Performance.

ALTHOUGH the second attempt to fly non-stop from Cranwell to Karachi was, like the first, not successful, although Flight-Lieutenants Carr and Mackworth did not succeed in flying their Hawker Horsley-Rolls-Royce machine further than Martlesham Heath, 85 miles from the starting point, the flight, begun at 12.40 p.m. last Saturday, June 18th, constitutes a notable flying performance. It was not so much the flight itself as the manner in which it was ended that calls for admiration. The machine started with about 1100 gallons of fuel on board, weighing about 3 tons. It was recognised before the flight started that with such a load it would be dangerous, if not impossible, to land the machine until it had been lightened by the consumption of at least ten or twelve hours' supply of fuel. It was difficult enough to get the machine into the air, but with its very high landing speed the abnormal load it was called upon to carry was regarded as prohibiting an early return to land. Yet when a defect occurred in the first hour of the flight—a leakage of oil, it is said—Flight-Lieutenant Carr decided to dispense with the use of the parachutes provided for just such an emergency and to endeavour to land and save the machine. Few expected him to succeed, and when it was seen that he was coming down immediate preparations were made to deal with an accident. None occurred. By a piece of brilliant piloting Flight-Lieutenant Carr and his companion not only escaped injury, but succeeded in landing the machine without damaging it in the least.

Centenary of the Fourneyron Turbine.

THE Société des Ingénieurs Civils de France has celebrated at a special meeting, under the presidency of the President of the Republic, the centenary of the invention which made the hydraulic turbine what it is to-day. That invention was made a hundred years ago by Benoit Fourneyron, who was then twenty-four years of age. He was a pupil of Burdin, who had already done a great deal in the way of developing the theory of the turbine, and although mathematicians like Leonard and Albert Eulen had worked on the problem, none of the experimental turbines based on their calculations had given an efficiency of more than 25 per cent. In 1822 Burdin appears to have laid the foundation of the modern turbine theory when he suggested the construction of a machine in which "the head of water should be divided into two equal parts, one giving to the wheel without shock the same circumferential speed as the velocity of the water and the other producing the effort." A year later the Société d'Encouragement pour l'Industrie Nationale offered a prize of 6000f. "for the application in a satisfactory manner to works and factories of hydraulic turbines or Belidor wheels with curved paddle blades." In 1827 Fourneyron produced his first machine, which developed 6 horse-power with a head of 1·40 m. The first turbine on the new principle, which absorbed practically all the energy of the water, leaving only just the velocity necessary to ensure the flow away from the machine, was installed at Pont-sur-l'Oignon (Haute-Saône), where it was found to have an efficiency of more than 80 per cent. At the end of 1833 Fourneyron presented to the Société d'Encouragement a voluminous treatise on the hydraulic turbine and was awarded the Society's Grand Prix.

Profit-Sharing in 1926.

STATISTICS relating to the operation of profit-sharing and co-partnership schemes during 1926 have been issued by the Ministry of Labour. Notwithstanding the industrial troubles which characterised last year, the results given do not differ greatly from those of the preceding twelve months, as given in THE ENGINEER for June 25th, 1926. The Ministry reports that there were 280 profit-sharing schemes known to be in existence at the end of the year, but only in 205 instances is it able to give particulars. The 280 schemes were operated in connection with firms employing 399,800 workpeople, of whom 192,900 were eligible to participate. The 205 schemes of which details are given included 160,000 participating employees, who received an average bonus of £9 8s. 7d., or an average addition to their earnings of 4·4 per cent. In the "engineering, shipbuilding and other metal" group of trades, forty-four schemes, employing 71,900 workers (22,200 participating), were known to be in operation. Full returns were made in twenty-eight cases, the report showing that as the result of the year's operations the 17,800 eligible workpeople received a bonus averaging £2 17s. 4d., or 2·6 per cent. on their earnings. In 1925 there were twenty-four schemes with 16,100 employees, who received an average bonus of £2 1s. 2d., or a 2·1 per cent. addition to their earnings. Three schemes were discontinued during the year, two of which, dating from the war period, were concerned with the engineering and allied trades. In both these cases the dissatisfaction of the firm with the results obtained is the reason given for the termination. Among the eleven new schemes reported, four have an engineering interest:—A firm of motor cycle manufacturers, with 3150 workpeople, distributes as a percentage on wages a cash bonus varying with the rise or fall of profits compared with a specified basis year; an electrical engineering concern, employing 1700 workers, allocates certain sums for depreciation and similar charges, and after 10 per cent. is paid on ordinary shares, divides the surplus between employees and shareholders; a mill furnishing company, after certain charges and a fixed percentage on capital have been met, gives as bonus half the surplus to the workers; an engineering and boilermaking firm sets aside the equivalent of 10 per cent. on share capital for dividends and reserve, and distributes to its workpeople a bonus equal to the first £500 of the remaining profits, together with one-half of any surplus remaining.

The White Star Liner Laurentic.

ON Thursday of last week, June 16th, there was launched from the East Yard of Harland and Wolff, Ltd., at Belfast, the triple-screw steamer Laurentic, which has been built for the Liverpool–Canadian service of the White Star Line. The Laurentic has an overall length of 600ft., with a breadth moulded of 75ft., a depth moulded of 45ft., while her measurement is 18,700 gross tons. She is designed to carry 1600 passengers in cabin, tourist third cabin and third-class accommodation. The propelling machinery has been built for a sea speed of 16½ knots, and comprises two four-cylinder triple-expansion steam engines, one on each of the wing shafts, which exhaust into a direct-coupled low-pressure turbine on the centre shaft. That turbine exhausts in turn into two condensers of the Weir regenerative type. Both the engine-room and deck auxiliaries will be largely electrically-operated, and to provide the necessary current for power and lighting, four 100-k.w. turbo-generator sets are to be installed. Superheated steam will be raised in four double-ended and four single-ended boilers, which will burn coal under natural draught. With a view to avoiding vibration, both the reciprocating engines and the turbine units have been specially balanced.

Motor Vehicles in the Dominions.

SOME interesting figures regarding the exports of motor vehicles from this country to the Dominions were given on Monday in the House of Commons by the Parliamentary Secretary to the Department of Overseas Trade. During the first five months of this year we exported touring cars, commercial vehicles and chassis to a total value of £1,621,313 to Australia, £220,161 to South Africa, £209,817 to New Zealand, and £33,138 to Canada, representing, all told, trade to the value of £2,084,429. An examination of the figures shows that 70 per cent. of the total trade is accounted for by the export of motor chassis to Australia. Compared with the exports during the first five months of 1926 and 1925, this particular section of the trade shows a very noteworthy increase, the 1927 figure being nearly double that of the 1926 figure and about 3½ times as great as the figure for 1925. This increase in the value of the exports of chassis to Australia has, however, been accompanied by a rapid and serious decrease in the value of the touring cars exported to the same country. A similar but much smaller increase in the value of the chassis and decrease in the value of the touring cars exported to Canada is revealed by the figures. The particulars for South Africa show a satisfactory tendency towards an increase in trade in all sections, but in the case of New Zealand there is as clearly marked a tendency towards a decrease.

The French Liner Ile de France.

THE new liner Ile de France, of the Compagnie Générale Transatlantique, which bears the distinction of being the largest ship constructed since the war, sailed on Wednesday afternoon, June 22nd, from Le Havre *vid* Plymouth to New York. She was built at the Penhoët Shipyard, St. Nazaire, and was completed in about thirty months. The following are her principal dimensions:—Length, 790ft.; breadth moulded, 99ft.; depth moulded, 65ft.; with a measurement of 43,500 gross tons. She has three black and red funnels—one of which is a dummy—and presents a neat and handsome appearance. Accommodation is provided for about 670 first-class, 408 second-class, and 580 third-class passengers, and a crew of about 800 is carried. The first-class public rooms are decorated in a new and modern style, and an innovation includes a chapel with seating accommodation for eighty persons. The propelling machinery comprises four sets of Parsons' type direct-coupled turbines designed for a total output of 52,000 S.H.P. On the recent trial run from St. Nazaire to Le Havre a speed of 24·01 knots was reported to have been attained. The sea speed will be about 23 knots. Steam is raised in twenty oil-fired boilers of the Prudhon-Capus type, twelve of which are double-ended and eight single-ended. Although the ship was built and engined in France, many British specialities are fitted. The gyro-compass equipment is by S. G. Brown, Ltd., of Acton, and the Thermotank punkah louvre ventilating system is installed. The lifeboat davits were supplied by the MacLachlan Automatic Boat Davit Company, Ltd. An interesting feature of the vessel is the provision to be made for carrying three seaplanes, which will take off from the ship when she is at a reasonable distance from the shore and so enable passengers to shorten their voyage if they so desire.

Co-operative Research in the Motor Industry.

WHILE industrial co-operative research with assistance from the Government is, in the case of certain industries, being well supported and is yielding valuable results, it is undoubtedly true that in others the scheme is not meeting with as much success as could be desired. A case in point is that of the Research Association of British Motor and Allied Manufacturers. Technically the work done by this body has been of great value to its members, but certain causes now at work indicate that the case for co-operative research in the industry may shortly require reconsideration and re-statement. According to the report of the Council for the year ending March 31st, 1927, the Association is supported by nine firms making motor vehicles and by a like number supplying fittings, steel and other materials. Three companies that were in the Association last year have passed through the hands of liquidators and amalgamations and working agreements have been effected between others, with the result that conditions in the industry as they affect co-operative research are totally different from what they were two or three years ago. For the second five-year period of its existence the Association entered into an agreement with the Department of Scientific and Industrial Research for the payment of block grants on a diminishing scale. It was stipulated in the agreement that the annual expenditure on research apart from depreciation was to be not less than £6000, and that the income of the Association was to increase progressively to £5400 per annum. It became clear that the prescribed subscription income could not be realised, and that the needs of the members could be met by an expenditure of much less than £6000 per year. It was therefore decided to terminate the agreement with the Department on March 31st, 1927. As regards the subscription income, the report states that many protests had been received against the high subscription rate of 3s. per £100 of wages paid, with a maximum of £500 per annum. The rate has now been reduced to 2s., with a maximum of £250 and a minimum of £50.

A Thames Ironworks Development.

IT is announced that the Thames Ironworks at Silvertown, the works and waterways of which site have been maintained by the London and North-Eastern Railway Company since 1912, have now been leased to S. Instone and Co., Ltd., the ship-owners and colliery proprietors, which firm will develop the site as a shipping centre. New wharves, together with docks, warehouses, and transit sheds, are to be built, and facilities are to be provided for the berthing of three or four 8000-ton steamers. Many alterations will require to be made before completing the new plans, and the work was formally begun on Tuesday afternoon, June 21st, when Sir Samuel Instone cut the first sod. An effort will be made, we understand, to have some of the shipping accommodation ready for October next. The new undertaking should be an acquisition to the Port of London, and the London and North-Eastern Railway Company is, we understand, co-operating with the new owners in providing railway facilities over its system with connections to all parts of the country.

Gun Trials of H.M.S. Nelson.

THE gun trials of the new battleship Nelson were held off Portland recently, in the presence of the Second and Third Sea Lords of the Admiralty and a group of ordnance experts. Although the firing took place at a distance of only 10 miles from the coast, the concussions were scarcely perceptible on shore, and there were none of the local phenomena which attended the discharge of much lighter guns at sea in pre-war days. The results of the trials are understood to have been entirely satisfactory. Particulars of the 16in. mark guns mounted in the Nelson and her consort, Rodney, have not been published, but they are known to be the most powerful guns of their calibre in existence, surpassing the American and Japanese models in weight of projectile, velocity, and energy. The shell discharged by the 16in. 45-calibre piece listed in the Vickers ordnance tables has a weight of 2461·2 lb., an initial velocity of 2525 ft.-sec., and a muzzle energy of 108,805 foot-tons, the gun itself weighing 108 tons. The design of the mountings for this exceptionally powerful weapon must have raised many new problems, especially in view of the fact that, judging from the unusual depth of the gun ports in the turrets of the Nelson, a high angle of elevation had to be provided for. Nor must it be forgotten that these are the first triple mountings for heavy guns to be installed in a British ship. The adoption of this method of mounting will inevitably lead to modifications in the present system of fire control, which is based on alternate four-gun salvos from the right and left-hand guns of four twin turrets.

Uniflow Marine Engine with Oil-operated Valve Gear.

ALTHOUGH Messrs. Sulzer Brothers have long been famous as builders of steam engines for land purposes, their name as marine engineers has become almost entirely identified with the development of the two-cycle Diesel engine. The following description therefore of a marine steam engine recently constructed by the firm will be of interest, and particularly so on account of the fact that the engine is designed on lines altogether different from the usual run of engines for ship propulsion. The engine in question furnishes the motive power for the saloon steamer Helvétie, a vessel with accommodation for 1600 passengers, built to the order of the Compagnie Générale de Navigation for service on the Lake of Geneva. The Helvétie is a paddle steamer with a length of 230ft. between perpendiculars, a breadth over the frames of 28ft. and a displacement of 560 tons. A view of the vessel is given in Fig. 1. Messrs. Sulzer Brothers, relying on the experience gained with a stationary engine, recommended the owners to equip the Helvétie with a uniflow engine with oil-operated valve gear in place of a steam engine of the usual marine type. It may be said that a uniflow engine with valve gear of the kind proposed had already been in service in England for some time, and its performance was so satisfactory that the prospects of success for a marine engine of the same type were regarded as certain.

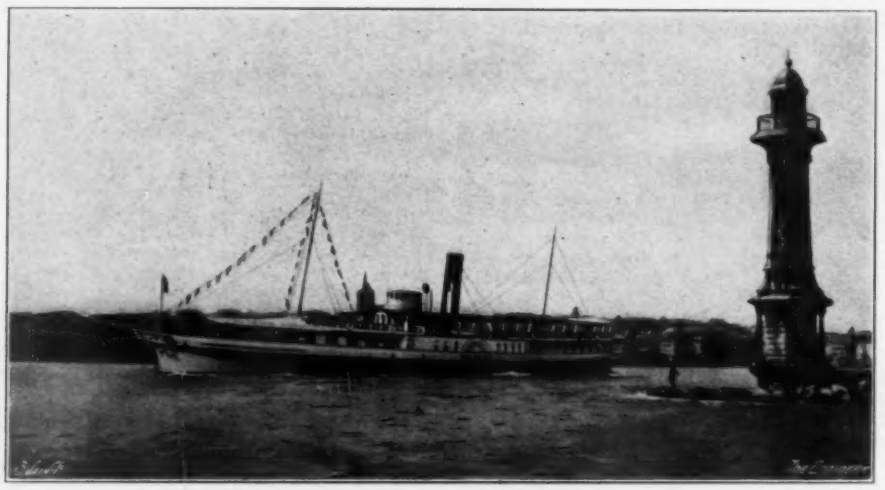


FIG. 1—THE PADDLE-WHEEL STEAMER HELVETIE

The engine installed for propelling the Helvétie is illustrated in Fig. 2. It is a three-cylinder uniflow steam engine developing 1500 B.H.P., running at 46 to 50 revs. per min., and giving the vessel a speed of 15·25 to 16·75 knots. The valve gear represents a complete departure from ordinary practice, the usual mechanical gear with excentrics, rods and links, being replaced by an oil-operated gear. Furthermore, the old methods of lubrication by grease cups and wick oilers has given place to a central forced lubrication system, thus bringing the engine into line in this respect with all high-class stationary steam engines. The absence of a large number of moving rods and links has greatly changed the appearance of the engine, the air of simplicity thus obtained being enhanced by the metal shields which partly hide the cranks and connecting-rods.

The construction of the cylinders will be understood from Fig. 4. The three cylinders are carried by a central casting which serves at the same time as an exhaust steam receiver, the exhaust steam passing from it to the condensers by means of two short pipe bends. The body of each cylinder is composed of two parts, bolted by flanges to the central casting. The adjacent ends of these parts do not meet, but have an opening between them which serves as a central exhaust port for the cylinder. In order that the piston and rings may pass over this port without difficulty, the ends of the half-cylinders which form the sides of the port are made of a waved form, the crests of one piece entering the hollows of the other, so that the piston rings are perfectly supported as they cross the opening. Reference to the drawing will make this point perfectly clear. The construction of the cylinder in two parts not only allows an unobstructed port opening round the whole of the circumference with consequently the minimum width of port, but also does much to eliminate dangerous heat stresses. The inlet valves of the single-beat mushroom type work on seats in the cylinder covers, thus reducing the clearance to a minimum. The keep the rod tight against steam pressure, is pressed outwards against a spherical seating, both by the steam and by several small axial springs. The outer packing, the principal function of which is to prevent the ingress of air when the pressure in the cylinder is below atmospheric, abuts against its seating in the opposite sense. Lubrication of the stuffing-box is effected from outside by an oil wiper on the rod, to which oil is supplied by the force pump lubricating the cylinder.

The length of the piston is about 90 per cent. of that of the stroke. The piston consists—as shown by Fig. 5—of four main parts, namely, two piston heads, a central piece and a slipper. The steam pressure is transmitted by one or other of the piston heads directly to the rod. The weight of the whole piston and rod is carried by the slipper. The latter is fitted with a spherical cup-shaped socket, in which the central piece rests, and which provides sufficient flexibility to avoid possible strains and distortions due to heat. Any wear of the rubbing surfaces due to continued service can be taken up by shims placed under the shoulder of the socket. Lubricating oil is introduced into the cylinder at six points by the cylinder oil pump. The crosshead also shows a departure from ordinary practice in the spherical joint connecting it to the slipper. The reason for a joint of this kind here, as in other parts of the engine, is to ensure uniform stressing of material, and to allow the parts to accommodate themselves to changes of form or of alignment caused by working stresses or heat or strainings of the ship's hull during rough weather, as the case may be. Uneven bearing of rubbing surfaces, with the consequent chances of the parts running hot, is also avoided elsewhere by spherical joints suitably disposed.

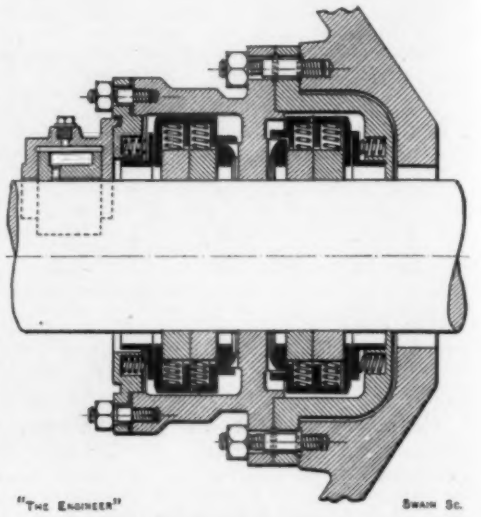


FIG. 3—PISTON-ROD STUFFING BOX

The small end of the connecting-rod is of the solid jaw type, in which the gudgeon pin is rigidly held. The end of the piston-rod is forged out to form an eye which holds the brasses embracing the centre part of the pin. To the underside of the forged end of the piston-rod is fastened a large bolt with the underside of its head turned to a spherical shape. This bolt is provided with a spherical washer, turned to the same

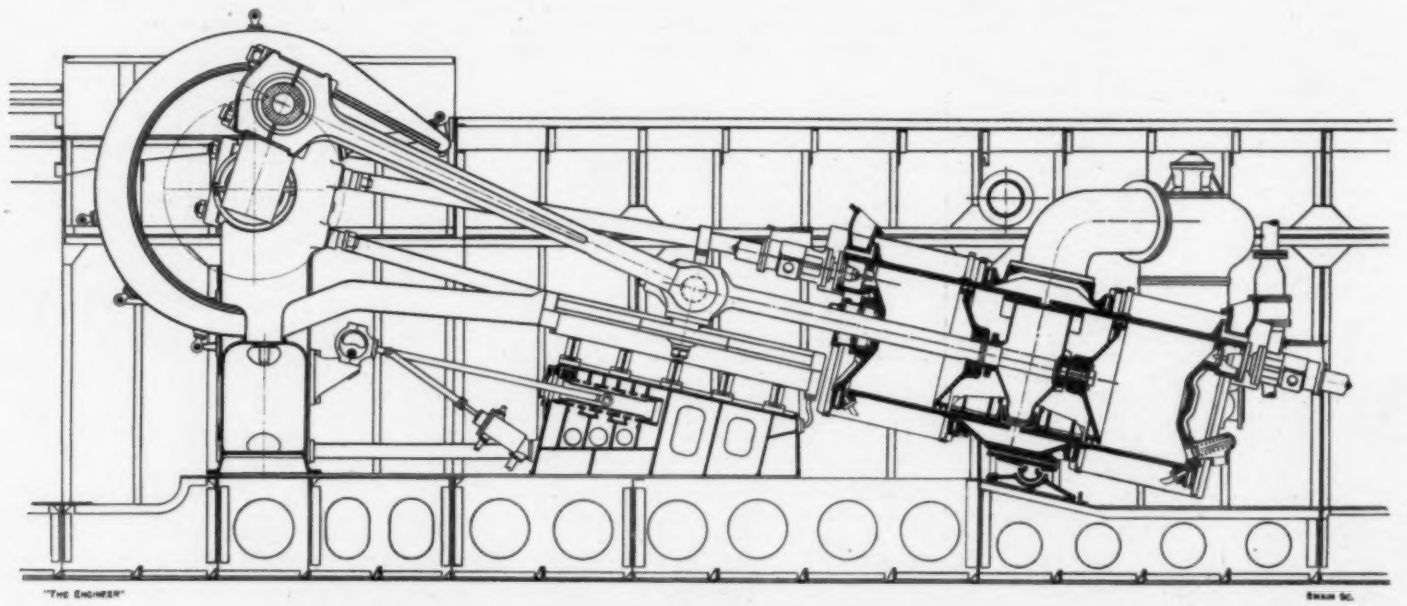


FIG. 2—LONGITUDINAL SECTION THROUGH ONE CYLINDER OF THE ENGINE OF THE HELVETIE

radius as the head. Between the head and the washer is a spherical ended bush, which forms the connection between the bolt and the slipper plate, the whole arrangement allowing the crosshead to align itself within reasonable limits. The oil for lubrication of the crosshead and slippers enters the hollow gudgeon pin by means of a hole drilled in the jaw end of the connecting-rod. From the centre of the gudgeon pin it passes out to the crosshead bearing, then downwards through the spherical bolt to lubricate the slippers, as shown in Fig. 6. The slippers and guides are of steel, with white metal rubbing surfaces on the former.

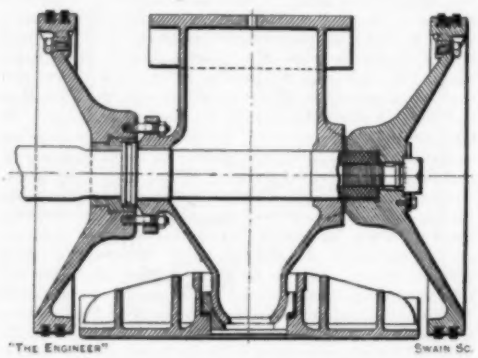


FIG. 5—SECTION THROUGH PISTON

The big ends of the connecting-rods are of the standard marine pattern, but here also the advantages of a spherical bearing have been made use of by providing the nuts and bolt heads with spherical working faces bearing on spherical washers. The bodies of the bolts are also turned down, so that their cross-section is approximately equal to that at the root of the threads. By these precautions it is made as certain as possible that the connecting-rod bolts are uniformly and centrally stressed, thus reducing the chances of breakage to a minimum. The crank pins are lubricated by oil coming from the main bearings through holes drilled in the shaft and crank webs. After serving the pins the oil passes down the connecting-rods and lubricates the crossheads as already described.

The main crank shaft bearings are constructed on the same principle as the big-end bearings. All four bearings are fitted in one common bearing frame. The cap-bolts serve at the same time as tie-bars to hold the connecting pieces between the cylinder block and the bearing frame, thus giving direct transmission of the forces from the cylinders to the bearings. By means of the bearing oil pump, oil is supplied to each bearing separately, and passes thence to the crank pins and crossheads.

The bearings for the paddle wheels are carried outside the hull on special supports, and they also are provided with forced lubrication. Since these bearings work in a continuous shower of water when the ship is under way, it was particularly desirable to evolve a design which would prevent any loss of oil and at the same time ensure that no water entered the bearings. The design adopted is shown in Fig. 7, and experience has shown that the combination of spray rings and baffles is quite effective. The body of the bearing is supported on two spherical pads, the idea being to allow the bearing surface to accommodate itself to the shaft in spite of unavoidable distortions of the hull. Since the resultant force on the bearing is always downwards, an upper bearing surface is unnecessary. The cap, therefore, is designed as a mere shell with the duty only of excluding dirt and water, and keeping the oil in. The lower half of the bearing is lined with white metal, and is lubricated with oil under pressure. The oil enters at the middle of the bearing, and passes from the central groove to each end, whence it is led away through the pipes shown in the drawing.

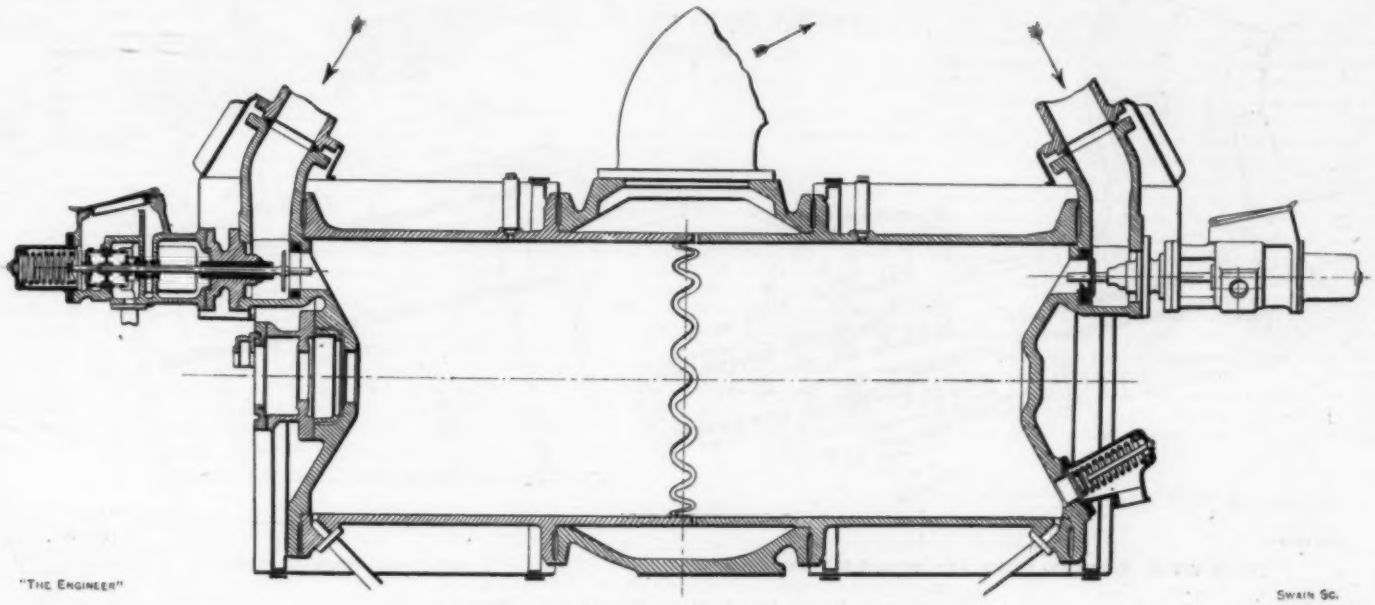


FIG. 4—LONGITUDINAL SECTION THROUGH ONE OF THE CYLINDERS

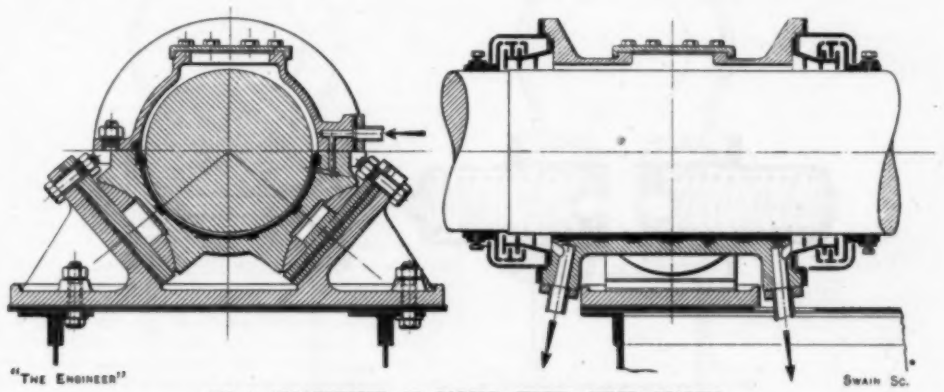


FIG. 7—ARRANGEMENT OF PADDLE-WHEEL SHAFT BEARING

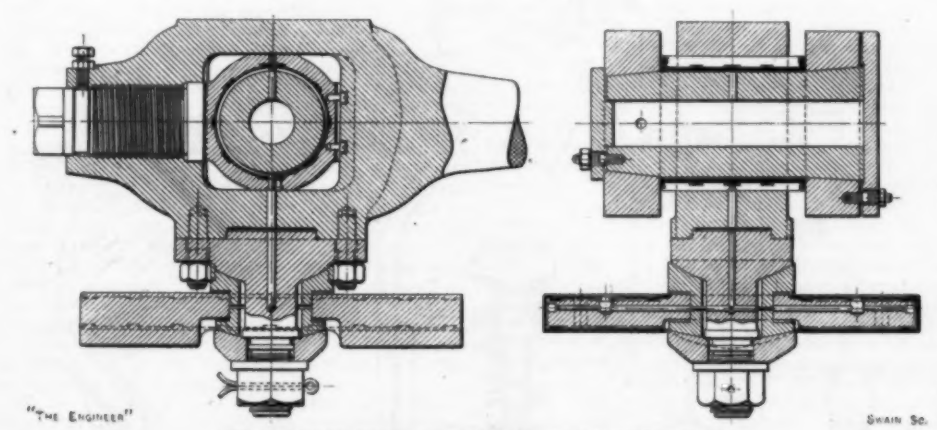


FIG. 6—ARRANGEMENT OF SMALL END OF CONNECTING ROD

Having now dealt with the chief mechanical details of the engine, we will turn to the feature which gives it its special interest, namely, the oil-operated valve gear. The principal advantages of this gear lie in the possibility of reducing considerably the dimensions of the engine, and also of being able to arrange the valves in any desired position. In marine work, in which space is always restricted, such advantages are of importance. Furthermore, a great number of mechanical moving, and therefore wearing, parts can be eliminated, with a consequent increase in simplicity and reduction in frictional losses. One of the steam admission valves, with its operating gear, is illustrated in Fig. 8. The valve itself is of the single-seated mushroom type, and is actuated by oil under pressure. The forces tending to close the valve are the steam pressure on the back of the valve V and the pressure of the spring F. The forces tending to open the valve are the oil pressure from the pipe O acting on the underside of the piston K in the oil cylinder M, and steam pressure in the cylinder Z acting on the underside of the valve V. The valve only begins to open when the compression pressure in the cylinder has reached its maximum value, since the oil pressure is not sufficient alone to open the valve against the steam pressure on its back. The oil-control valve, which is shown in Fig. 9, has therefore, during the normal running of the engine, only to operate the closing of the valve V when cut-off takes place, as the opening of this latter valve on the return stroke of the piston is determined by the compression in the cylinder. When the engine is starting the compression pressure is too small to open the valve against the steam pressure. In order that the engine may be capable of starting, it is necessary to reduce the admission steam pressure until the pressure of the oil alone is sufficient to open the admission valve. As soon, however, as the engine has made a few revolutions, the steam pressure can be raised to full boiler pressure. To cause the valve to

return quietly to its seat when closing and to come to rest without shock when opening, the motion of the piston K, shewn in Fig. 8, is arranged to close one after another a series of holes drilled helically through the walls of the cylinder M. The piston thus acts as an oil brake, and it brings the valve definitely to rest when finally a certain quantity of oil is trapped by it in the cylinder. In order to make the braking position conform exactly with the closing position of the valve, the cylinder M—Fig. 8—can be moved axially by means of the screw S, the worm wheel C and the thread G, thus obtaining very smooth motion of the valve. During opening and closing, the oil enters at first through the foot valves W_1 and W_2, until a sufficient number of the helically arranged holes through the piston has been uncovered.

The operating oil, which is brought to the requisite pressure by means of a special auxiliary pump, flows first of all into the space A of the valve chest K—Fig. 9—to which two oil storage vessels—Fig. 10—are connected in order to prevent the pressure varying too much. From the storage space A the oil passes into the annular space R_1 and is from here directed alternately into the annular spaces R_2 and R_3 according to the position of the control valve. The oil flows away from both these spaces over the control valve into the spaces R_4 and R_5, which are connected with the damping spaces P_1 and P_2 respectively. To each of the latter spaces an oil damping device, as shown in section in Fig. 11, is connected. After the valves have completely closed, this device acts as a quick brake on the oil columns in the pipes O_1 and O_2, so as to prevent liquid hammer. In order to prevent the columns being broken during the braking operation, an oil make-up valve U is fitted in the valve yoke—Fig. 8—and feeds oil at once to the columns as soon as any vacuum forms. During the period the valve V is opening, when there is pressure under the piston K, the make-up oil in the space R can be replenished again through the holes L and any surplus can reach the drain pipe by the overflow T.

The operating valve is driven by an excentric—Fig. 13—and the angle of lead can be adjusted as required by means of a four-wheeled mechanism. The toothed wheel, the driving wheel, is keyed firmly to the main shaft and drives the first wheel of the four-wheeled mechanism. The driving mechanism also acts on a second wheel which is arranged to swing about the centre of the first wheel. The axis of the second wheel is carried in a swinging lever H_1—Fig. 13—which can be turned ± 15 deg. from its central position. The same motion moves the third wheel about the centre of the fourth wheel by means of a rod. The total adjustment of the angle of lead thereby given to the fourth wheel, which is keyed to the excentric shaft, amounts to ± 60 deg. with respect to the main shaft. The swinging lever H_1 is brought into its various positions corresponding to the desired direction and speed of rotation by means of the operating lever G and the servo motor M. The quadrant Z_1, which is in one with the operating lever G, is furnished with teeth that mesh with a toothed wheel Z_2 which is keyed on the same shaft as an excentric X. On the excentric there is pivoted a double-armed lever, to which the valve rod H_4 and the return motion rod H_5 are connected. The control valve S, in accordance with its position as determined by the operating lever, directs oil under pressure either under the servo motor piston K or from there into the outlet space, until the return motion has brought the control valve back into its central position. In this manner the reversing lever H_1 always takes up a definite position corresponding to each position of the excentric X as determined by the operating lever.

In a similar manner to the reversing gear, the main steam valve is also opened and closed by the operating lever G—Figs. 12 and 13—of the service gear through an oil-operated mechanism with servo motor and control valve. As can be seen in Fig. 12, there are four members, which adjust the pressure of the steam flowing into the engine in accordance with the position of the operating lever. The first member directly affected by the operating lever by means of the cam C is the oil pressure regulator fitted in the casing of the service mechanism; the purpose of the regulator is to adjust the pressure of the oil in the pipe L_1 in accordance with the position of the operating lever. Corresponding to the tension of the spring as determined by the cam C, the control valve S_1 allows oil under pressure to pass from space R_6 into space I_1 or,

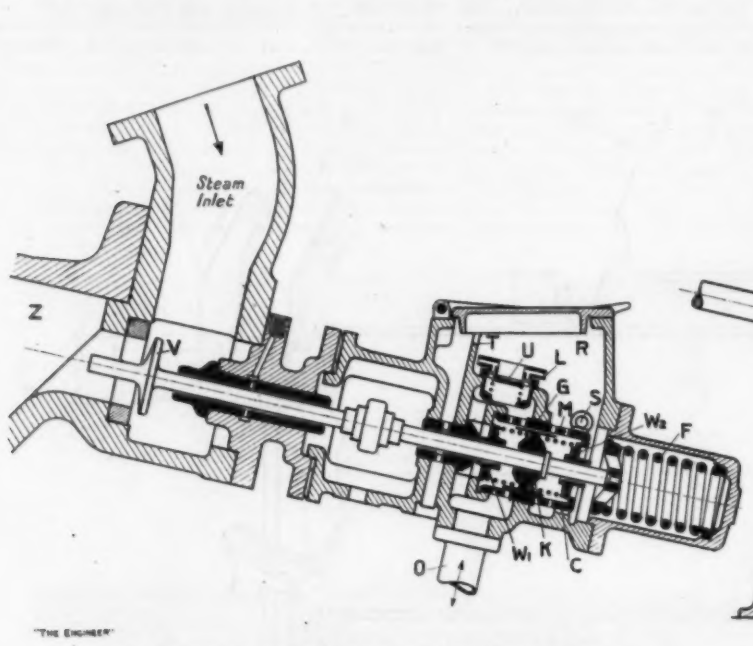


FIG. 8—STEAM ADMISSION VALVE AND OPERATING GEAR

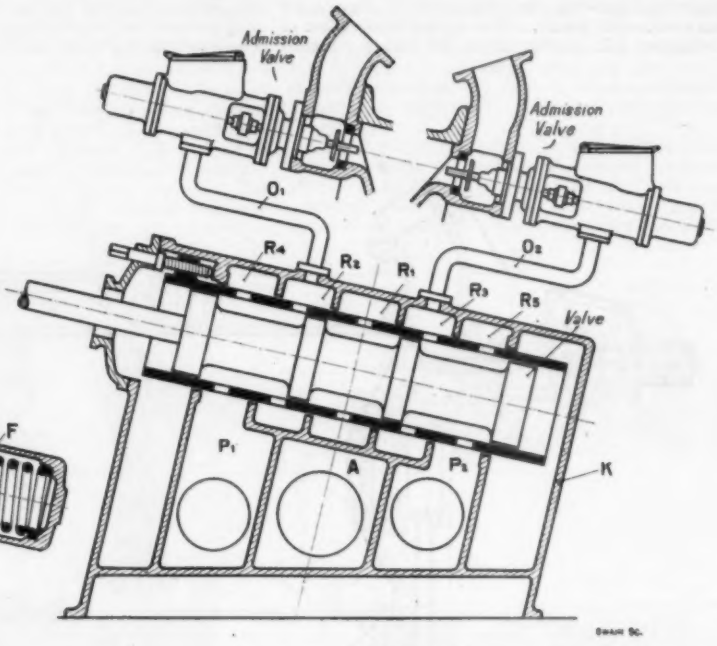


FIG. 9—OIL CONTROL VALVE

FIGS. 10 AND 11—OIL STORAGE VESSEL AND OIL DAMPING DEVICE

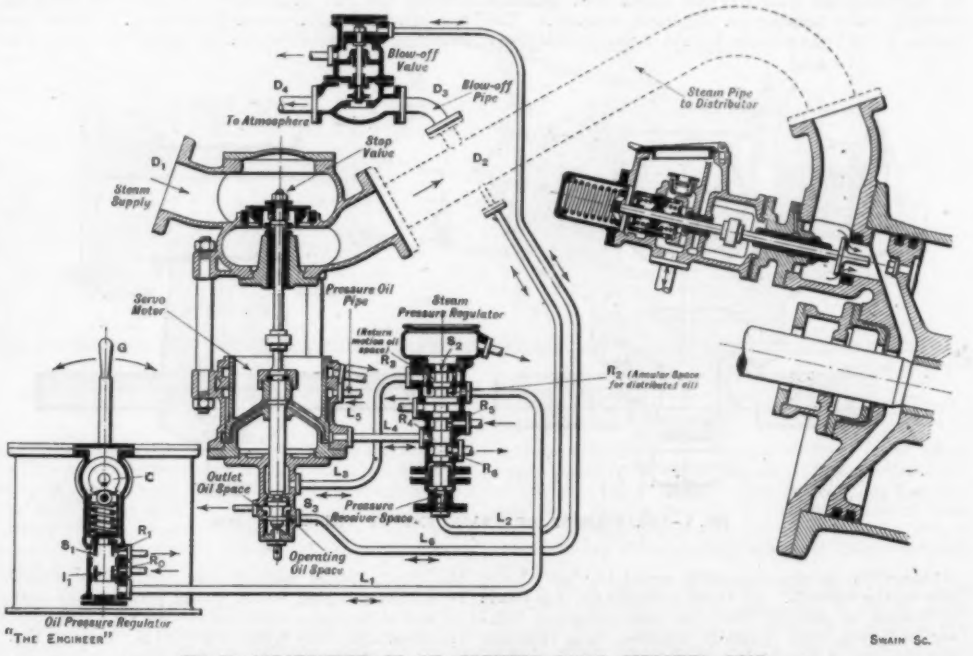


FIG. 12—ARRANGEMENT OF OIL-PRESSURE VALVE-OPERATING GEAR

in the opposite direction, from space I_1 into space R_1, thus regulating the oil pressure in the space I_1 and pipe L_1.

The control valve S_2 in the steam pressure regulator regulates the operating oil for the servo motor of the main steam valve in accordance with the hand-regulated oil pressure and the steam pressure in front of the admission valves. The operating forces are, on the one hand, on the control valve S_2, the pressure of the hand-regulated oil in the pipe L_1, and, on the other hand, the admission steam pressure in the pipe D_2 by means of the pipe L_2 on the piston arranged under the control valve, and also the pressure of the oil from the return pipe L_3. The annular space R_4, connected through the pipe L_4 with the servo motor, is connected with the inlet space R_3 or with the outlet space R_5, according as the control valve is below or above the central position.

When the operating lever is in the "stop" position the oil pressure in the pipe L_1 is adjusted to its lowest figure; the control valve S_2 is thus pressed upwards by the small spring on which it rests, and the oil can consequently flow away from the servo motor through the pipe L_4 into the outlet space R_4, so that the stop valve is closed. In the end position the servo motor spindle forces the control valve S_2 against the oil under pressure flowing in from below and thus opens the way for the oil from the servo motor of the blow-off valve through the pipe L_5 to the outlet. If there is still a certain steam pressure in the pipe D_2 from previous working of the engine, it can escape through

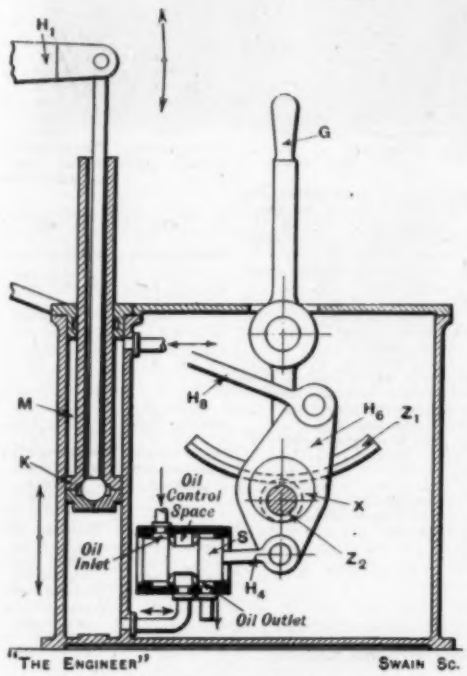


FIG. 13—HAND OPERATING GEAR

the pipe D_3 and the release valve into the pipe D_4 and from there to the atmosphere, so that the pressure in front of the admission valves is zero.

As will be seen from what has been said above, the engine can only start with low pressure and large cut-off. The cam C of the control gear is therefore made of such a shape that it only gives a small tension to the spring when in the starting position 1, ahead or astern. This causes a slight excess pressure in the pipe L_1 and in the space R_2, which pressure can balance only a low steam pressure on the control piston. As soon as the pressure in front of the admission valves has reached a higher figure, the control valve S_2 is raised by the control piston, so that the operating oil flows away from the servo motor and the stop valve closes again and remains closed until the hydraulic return motion mechanism $L_2 R_2$ has established balance. At the same time, in order to ensure the engine starting, the four-wheeled mechanism is, in this starting position 1 of the operating lever G, set to maximum cut-off, for running ahead or astern as required. In the subsequent positions of the operating lever the oil pressure in pipe L_1 is gradually increased and, in conjunction therewith, the steam pressure in admission pipe D_2 is also increased, whilst the cut-off is reduced from the maximum to the minimum value.

By the single operating lever of the service mechanism the main steam valve and the reversing gear are adjusted simultaneously by one easy movement, whilst in engines as hitherto built the main steam valve is opened or closed directly by means of a lever and reversing is effected by a hand wheel, thus requiring complicated movements and, in the case of large engines, very great exertion on the part of the engineers in charge. Incorporating two difficult operations in one single easy movement, means, of course, quick manœuvring, an advantage by no means to be underestimated, especially on board ship.

The Helvétie was put into commission in the middle of September, 1926, and was in regular service for a month. During the six winter months, when the service is greatly reduced, the ship was laid up and was put into service again in May last.

Centenary of the First Railway in France.

By J. G. H. WARREN.

ON Sunday, June 12th, was celebrated at St. Etienne, the centenary of the railway from that town to St. Andrézieux, on the Loire.

Of the French railways it can be said, as of those in England, that they owe their origin to the needs of the coal-mining industry. The town of St. Etienne, now equally celebrated for its manufactures of silks and of *confitures*, was in the beginning of the nineteenth century already the centre of an important coal-producing industry, remarkable for its seams varying in thickness from 30ft. to 70ft., which, running at a high angle, have to be worked by a special method in horizontal slices.

The attention of French engineers having been directed by de Gallois to the colliery railways in the North of England, a concession was obtained by several mineowners and engineers for the construction of the railway above mentioned, which was opened in May, 1827. Like the Stockton and Darlington Railway, it was intended only for the transport of coal and merchandise, and although de Gallois had reported at some length on the *chevaux de fer*, which he had seen at Killingworth, they were not employed, evidently because the lay-out of the railway was unsuitable for their use. "*Si le chemin est horizontal*," he wrote, "*on se sert de chariots armés de machines à vapeur à haute pression.*"[1] But the line from St. Etienne to Andrézieux was far from satisfying such conditions, for it practically followed the natural contours of the district, and the motive powers were gravity and horses as the circumstances required. The rails—of which an example was on exhibition—were of the Stephenson-Losh fish-bellied type in cast iron, carried in chairs on stone blocks.

The next step in French railway development was the undertaking of a line from St. Etienne to Lyons, which should link the Loire, by means of the existing line from Andrézieux, with the Rhone, by the projected line to Lyon. The traveller to-day follows the line as originally traced out, to overcome great natural difficulties, by engineers who must have had a very limited experience in such work, except from their observation in England. It was in this connection that Marc Seguin established his reputation as a railway engineer, and made the remarkable experiments with the multitubular boiler which have only recently been brought fully to the light.[2] Although it has long been known that Seguin had conceived the idea of a multi-fire-tube boiler as early as December, 1827, the actual date and the extent of his attempts to put the idea into practice had remained matters for conjecture, particularly in view of certain incorrect statements on the question—as, for instance, that a locomotive with a multitubular boiler had been built by him in 1827,[3] *i.e.*, two years before the actual event.

It is now definitely established, however, from original documents—see Fig. 1—that Seguin had pursued the idea experimentally for a year or more before the Stephensons undertook the application of its principle to the boiler of the Rocket, and it seems probable that had they known of the results obtained by him in 1828, not only their own experiments with the twin flues of the Lancashire Witch, but the Rainhill Trials might have been unnecessary. But St. Etienne is a long way from Darlington and Newcastle-upon-Tyne, even to-day by the grand *trains rapides* of the P.L.M. Railway, the heir of the lines from St. Etienne to Andrézieux and to Lyons, and, whatever the reason, it appears that the voluminous correspondence and records of Seguin which have been preserved at his old home at Varagne, near Annonay, with enviable appreciation for their value, have not yet yielded any evidence of communication with George Stephenson on this subject.

Now the construction of his locomotive was, as has been pointed out by Monsieurs Achard and Seguin in their paper, obviously a more difficult undertaking for Seguin than for the already experienced workshops of the Stephensons; consequently, though his experiments had been begun some time previously, they did not materialise as a complete locomotive till after the Rocket had flashed across a stage set for a widely advertised sporting event. By the irony of fate, Seguin's work had no such setting, and the world generally learnt of, and received, its multitubular boiler at the hands of the Stephensons. But Seguin's records are the complete justification for the honours claimed by his fellow-countrymen for his prior practical work in this direction—in France he is called the "Inventor of the Tubular Boiler"—and the celebrations at St. Etienne on June 12th, though concerned with the centenary of a railway preceding his own, were also made the occasion for the unveiling of a bust at the Chateaucreux Station of that town, where the ceremony was performed by Monsieur Tardieu, Minister of Public Works, supported by the President and Director-General of the P.L.M. Railway Company.

The bust is in harmony with one's conception of a remarkable man—scientist, philosopher and practical engineer—of whom his descendants and countrymen are justly proud. There is perhaps no contemporary book in England which corresponds in treatment with his book, "Sur l'Influence des Chemins de fer et de l'Art de les tracer et de les construire."

The author could recognise that too much abstract science might be a stumbling block to practical minds, and that scientific arrogance and over-much specialisation were grave dangers, to be avoided. Both dogmatist and empiricist, he was not too proud to retrace his steps, or, indeed, the line itself from St. Etienne to Lyons, after he had taken the opinion of Stephenson, Brunel and other English engineers on the desirable minimum for curves.

Seguin published numerous books. Among others, one on the teaching of science, in which he wrote: "C' est en apprenant aux enfants, en 1793, a lire dans le *Contrat Social*, et en leur faisant reciter *les Droits de l'Homme*, au lieu de mettre entre leurs mains *l'Imitation de Jesus Christ*—que l'on à developpé

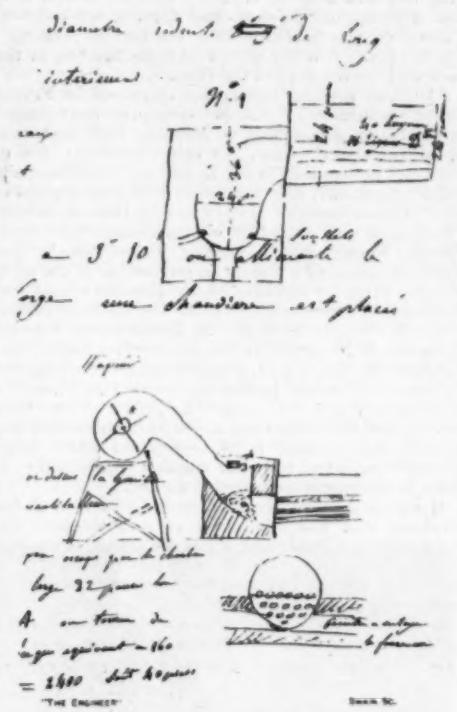


FIG. 1—FACSIMILE OF SEGUIN'S SKETCHES, 1827-8

l'esprit subversif et socialiste si difficile maintenant a comprimer et à faire rentrer dans les bornes de la justice et de l'equité." He was in correspondence with the greatest English scientists of his day, and among the letters preserved at Varagne are many from W. R. Grove, Q.C., F.R.S., whose important book on the "Correlation of Physical Forces" was published in 1846.[4] Thanks to his efforts, a French translation of his book was published in 1867, with "Reflexions et Annotations," by Seguin, who had been delighted to find that Grove's theories on heat and work, then almost revolutionary, coincided with theories which had been stated some years previously by himself, who had imbibed them from his teacher and uncle, Montgolfier. Their first correspondence led to a visit from Grove and his family, who stayed for a month at Varagne.

The philosophy which he deduced from his own studies in physical science had led Seguin to the same conclusion as Grove—"La causation est la volonté, la creation est l'acte de Dieu"—a conclusion which is being approached again to-day by physicist philosophy after its wanderings in the wilderness of materialism.[5]

Not only in his previously expressed theories on the relation between heat and work was Seguin—Fig. 2—in advance of his time, but as a practical engineer he led the way in the building of iron suspension bridges; he foresaw the probability of asphalt roads for use by locomotive engines, and, in a "Memoire sur l'Aviation," in which he had no doubt a natural interest, owing to his relationship with the brothers Montgolfier, he saw in 1866 that the future of aerial navigation must be with the heavier-than-air machine rather than with the balloon. Such was the man whom St. Etienne delighted to honour, and

[1] "Annales des Mines," 1818.

[2] Paper read before the Newcomen Society, London, April 20th, 1927, "Marc Seguin and the Invention of the Tubular Boiler," by Messieurs F. Achard and L. Seguin.

[3] Catalogue of Exhibits, Conservatoire des Arts et Métiers, Paris, and various French writers.

[4] Afterwards Sir W. R. Grove (1811–1896) (Q.C., 1853), judge and scientist, inventor of the Grove battery, &c.

[5] *Cf., e.g.*, "Religion in the Making," A. N. Whitehead, D.Sc., F.R.S. (Cambridge, 1927).

whose memory deserves perhaps more notice than it has received from Englishmen.

To such who were present at the ceremony, it was gratifying to find that the name of Stephenson is still one to conjure with, and to see in a conspicuous place, altered in some detail, but much in its original state so far as general appearance could show, a Stephenson long boiler engine of the type 2–2–2, sent to France in 1846, of which no single example has been preserved in the country of its origin. The celebrations also included very properly an historical exhibition arranged by Monsieur Ferdinand Achard, whose knowledge of French locomotive history is unique, and the more remarkable in a country where there is no such "cult" of railways, and all that concerns them, as there is in England. Yet there can be few countries to-day where the student of locomotive development can get such a panoramic view from examples still at work, and the interest of the living collection is enhanced by the addition of German and American locomotives since the war.

The historical exhibition at St. Etienne included the model of Seguin's first locomotive, of which there is a replica at the Science Museum, South Kensington. One of his later locomotives is shown in the contemporary print by Engelmann, and in the replica of a wallpaper—Fig. 2—which had been preserved until lately in a house in the district, showing scenes on the Lyons–St. Etienne Railway. In this locomotive Seguin retained the cylinder arrangement introduced with the first English engine imported, which, it is now definitely established, had actually worked previously on the Stockton and Darlington Railway; but the boiler is fitted with a separate fire-box at the back end, on the lines of the Rocket.

The next type of locomotive employed in France was of Stephenson's "Planet" design, on the railways of the Loire, Andrézieux to Roanne, 1833, as shown by an original drawing. Of other drawings, one of the most interesting, found among the records of the P.L.M. Company, shows a locomotive described as of the "Anglo-American" type, built by Hick of Bolton. This engine was, in fact, of Norris' design, with single driving wheels and a leading bogie, which had suddenly acquired a European reputation as the most suitable type for working heavy gradients, and was obtained, in consequence, for the Rue-de-Gier section of the St. Etienne Railway. In England also, Captain Moorsom, R.N., after a visit to America, had recommended the use of such locomotives for working the exceptionally severe Lickey incline of 1 in 37 on the Birmingham and Gloucester Railway. There they had a much advertised and apparently successful, but actually brief career in their original state, being shortly converted to tank engines, presumably in order to increase their adhesive weight.[6]

Monsieur Achard remarks, in his catalogue of the exhibits, that the reputation of such engines was "not well founded," and it has often been suggested by English writers that Moorsom was compelled to buy them because English builders had refused to supply locomotives to work such an incline as the Lickey, considering that it could not be worked by locomotives at all. But Moorsom himself wrote in 1839 that "*the question of making locomotive engines of the kind* (*sic*) which led to the order [to Norris of Philadelphia] was discussed with two makers of celebrity in this country in the first instance, and it was not until they had declined to undertake an order that a negotiation was set on foot with an American engineer."[7] This appears to put a different complexion on the whole affair and to justify the refusal of the English builders to supply a type which was obviously less suitable than others they had actually built.

The next remarkable drawing in the exhibition at St. Etienne shews the locomotive with steam tender designed by Verpilleux in 1844, and actually employed on the Lyons–St. Etienne Railway, thus anticipating by many years Sturrock's work in England on the Great Northern Railway. Many of the succeeding contemporary drawings and prints show the influence of early English designs on French practice, particularly of Stephenson's long boiler and Crampton's rear-driver types. The influence of the latter survives to-day in the position of the outside cylinders of many modern French types, and, by a curious irony, returned to England with the de Glehn compound locomotive La France supplied in 1903 to the Great Western Railway by the Société Alsacienne de Constructions Mecaniques; it appears to-day alone in England in the four-cylinder locomotives on the Great Western Railway, which were derived in the first instance from La France.

FIG. 3—MARC SEGUIN

Monsieur Achard remarks that the locomotives constructed after 1865 generally do not present the same historical interest; but examples are given in the exhibition up to the latest types. Most of these can, however, be studied in actual operation during a journey from Boulogne to St. Etienne, as already mentioned. It was interesting, for instance, to find on the journey to Paris that the train was hauled by a four-cylinder "Atlantic" of the "La France" type. Comparing the much larger "Pacifics," by which most of the heavy express work in France is now performed, and particularly the "Nord" type with its short barrel and long, narrow fire-box, with the P.L.M. type with long barrel and short, wide fire-box, one reflected that boiler proportions appear to be to-day, as they were with Gooch and Stephenson, largely a matter of opinion. The whole journey might well be considered, so far as the writer is concerned, as part of a centenary celebration, which he will always remember, not only for its historical and technical interest, but for the great courtesy received from railway companies and individuals alike. Not the least of these courtesies was the pleasure of a day and night spent at Varagne, in the beautiful country home of Marc Seguin, where library, observatory and workrooms have been preserved much as they must have been in his lifetime, and during the visit of Grove, and where, still more remarkable perhaps in these days, the noise of our modern civilisation has hardly penetrated. One wondered what Seguin's philosophic mind would have thought of some of the logical, but certainly least desirable results, of his own personal efforts to improve the world's means of transport.

FIG. 2—REPRODUCTION OF AN OLD PRINT SHOWING THE LYONS–ST. ETIENNE RAILWAY

[6] Report to Brunel dated October 20th, 1843, G.W.R. Records, Paddington.

[7] *Railway Times*, August 3rd, 1839, page 593.

Institution of Electrical Engineers' Summer Meeting.

No. II. (*Conclusion*).*

ON Wednesday morning, June 15th, a visit was paid to the North Tees power station of the Newcastle-upon-Tyne Electric Supply Company, Ltd., and associated companies, which supply an area of 1600 square miles. There are now thirty-four stations working in parallel, with a yearly output of approximately one thousand million units. Twenty stations are owned or operated by the company, and the yearly output from these stations is approximately nine hundred million units; two hundred million of these units are generated by means of waste heat. The demand on the company's system is 175,000 kilowatts.

TABLE I.—*Equipment of the North Tees "B" Station Turbo-alternators.*

	C. A. Parsons and Co., Ltd.	Metropolitan-Vickers Electrical Co., Ltd.
Number installed	Two	One
Output of each set—		
Maximum continuous rating at 0·75 lagging power factor, kW	25,000	20,000
Economical rating, kW	20,000	16,000
Voltage	11,500	11,500
Periodicity, cycles per second	40	40
Revolutions per minute	2,400	2,400
Type of turbine	Two-cylinder reaction type	Two-cylinder Rateau with one Curtis wheel
Normal pressure at turbine stop valve, lb. per sq. in. above atmosphere	450	450
Normal temperature of steam at stop valve	700 deg. Fah.	650 deg. Fah.
Maximum temperature of steam at stop valve	750 deg. Fah.	750 deg. Fah.
Normal vacuum in condenser (30 deg. bar.), in.	29	29½
Number of stages—		
High-pressure	17	6
Low-pressure	8	10
Points at which steam is bled for feed heating, absolute pressure, lb. per sq. in.	85, 36, 12	† 60, 17, 5
Feed water heated to	300 deg. Fah.	300 deg. Fah.
Number of alternators per set	1	2
Type of exciter	Direct-coupled with outboard bearing	Overhung with radial commutator
Excitation voltage	220	210
Number of main bearings	6	8
Ventilation	Independent motor-driven fan. Closed circuit air coolers	Partially by fans on rotor, partially by independent motor-driven fans. Closed circuit air coolers
Type of external reactance	None	Oil-cooled

Boilers.

Maker	Babcock and Wilcox, Ltd.
Type of boilers	Water-tube
Number installed	Eight
Heating surface of boiler	12,028 sq. feet
Heating surface of superheater	2,309 sq. feet
Heating surface of air heater	17,000 sq. feet
Grate area	324 sq. feet
Water economisers	None
Type of stoker	Forced draught compartment type
Normal working steam pressure at superheater outlet, lb. per sq. in. above atmosphere	475
Normal working steam temperature at superheater outlet	700 deg. Fah.
Normal evaporation per hour per boiler	75,000 lb.
Continuous overload capacity	25 per cent.
Air pressure in F.D. air duct when boiler is steaming at normal evaporation	2in. of water
Mechanical draught—	
Forced and induced draught fans	Davidson's Sirocco, driven by common motor; separate set for each boiler
Number	Eight
Power required per fan at normal evaporation	74 kW

The route length of cables laid and lines erected is 1550 miles and there are 626 sub-stations. Over 100,000 consumers are supplied directly from the system and through bulk supplies, the number of consumers directly connected exceeding 60,000.

The North Tees power station, about which a good deal has already been written,† is situated at Haverton Hill, in the county of Durham, on the north bank of the river Tees, opposite to the town of Middlesbrough. The area of the site is 56 acres with a river frontage of nearly half a mile. As the illustration Fig. 8 shows, and as many of our readers are no doubt aware, the station is built in two sections. The "A" station, to be seen on the left, was put into operation in 1920,

* No. I. appeared June 17th.

† See THE ENGINEER, June 13th, 1924.

whilst the first part of the "B" station, to be seen on the right, was set to work in 1923, the remainder now being on the point of completion. In the "A" station there are two 20,000-kilowatt turbo-generator sets built by the Metropolitan-Vickers Electrical Company, each machine consisting of a high and low-pressure turbine and two 10,000-kilowatt, 11,000-volt alternators in tandem running at a speed of 2400 revolutions per minute. The turbines are of the single-flow type in opposition, and the last stages of the low-pressure turbines are designed on the multiple exhaust principle. Normally the two generators are operated as one unit, but either generator can be

FIG. 8—THE NORTH TEES ELECTRIC POWER STATIONS

used separately. In the boiler-house of the "A" station there are ten Babcock and Wilcox boilers, each having a capacity of 42,000 lb. per hour and designed for a steam pressure of 475 lb. per square inch. The temperature of the steam is 700 deg. Fah. The five boilers on the side of the boiler-house nearest to the turbines are fitted with re-heaters, which raise the temperature of the steam during its passage from the high-pressure to the low-pressure turbine of each machine to 520 deg. Fah. In place of economisers air heaters are used and the temperature of the air supplied to the grates is about 400 deg. Fah. All the boilers discharge into one chimney, 16ft. in diameter and 180ft. high, with a common fan equipment. Five of the boilers can, if necessary, be worked with oil fuel. The feed water is heated first by steam drawn at two stages from the low-pressure turbines and then by steam taken from the high-pressure turbine exhaust, its final temperature being 300 deg. Fah.

The "B" station, with which we have not previously dealt, contains a 20,000-kilowatt, turbo-generator manufactured by the Metropolitan-Vickers Electrical Company and two 25,000-kilowatt Parsons' sets of the usual reaction type, with a high and low-pressure turbine and a single altrenator. The low-pressure cylinder is of the double-flow pattern with

TABLE II.—*Condensing Plant in "B" Station.*

Maker	C. A. Parsons and Co., Ltd.	Metropolitan-Vickers Electrical Co., Ltd.
Type of air pump	Horizontal water extraction pump and air ejector	Le Blanc rotary
Method of drive	Direct-coupled motor	Direct-coupled 400 B.H.P. motor, also driving ventilation fans
Number of condenser sheels per set	2	1
Cooling surface per set, sq. ft.	19,000	25,000
Quantity of cooling water, gallons per minute	21,000	26,000
External diameter of tubes, in.	1	1
Circulating water pumps and screens	Extension to pump house of "A" station	
Condensate system—		
Type	Closed feed system	
Boiler feed pumps—		
Type and number	Three electrically driven and one Weir steam-driven	
Capacity per pump, lb./hr.	375,000	

twin condensers. In the case of these machines, which are shown in Fig. 10, the steam entering the low-pressure turbines is not re-heated. The main technical particulars of the generating units and boiler plant are given in Table I.

A view of the boiler-house is given in Fig. 9. Coal is delivered into the bunkers over the boilers by means of a belt conveyor made by Fraser and Chalmers, Ltd., whilst the ashes are removed by water trough scraper type ash conveyors supplied by the Underfeed Stoker Company, Ltd. The capacity of the coal conveyor is 300 tons per hour. The circulating water pumping plant, which is common to both stations, consists of four vertical centrifugal pumps manufactured by Gwynnes Engineering Company, Ltd. Details of the condensing plant and feed pumps are given in Table II.

The main ironclad Reyrolle switchgear operates at 11,000 volts. The bus-bars are in duplicate and a very complete interlocking arrangement ensures that all movements are carried out in the correct sequence. As the supply pressure in the area in which the station is situated is 11,000 volts, the generators feed straight into the mains, but two step-up sub-stations on the site raise the pressure to 20,000 for providing a supply to distant consumers and to 66,000 volts for linking up with the company's power stations on the river Tyne. In Middlesbrough and other districts south of the river Tees the cable network is connected to the station by some twenty cables laid in a trench dredged in the river bed at a depth of 30ft. below low water.

After the station had been inspected luncheon was provided by the company, and in the afternoon the main party proceeded to Durham, where it visited the cathedral, the old monastery with its fourteenth century kitchen, and the library. By the kindness of the Dean, the Right Rev. Bishop Welldon, tea was provided in the Deanery. A subsidiary party, limited to one hundred members, visited the pithead of the Blackhall Collieries of Horden Collieries, Ltd., tea being provided at the colliery offices by invitation of the company. To meet the wishes expressed by visitors at previous meetings, no formal plans were made for the evening.

On the morning of Thursday, June 16th, two alternative visits were arranged, one to the Elswick Works of Sir W. G. Armstrong, Whitworth and Co., Ltd., and the other to the Ford Potteries of C. T. Maling and Co., Ltd. In the afternoon the Potteries again appeared on the programme, but there were also several alternative visits, namely, to the Wallsend shipyard of Swan, Hunter and Wigham Richardson, the works of Clarke, Chapman and Co., Ltd., and the new library of the Armstrong College. In company with a section of the Institution's members we visited the works of Clarke, Chapman and Co., Ltd., where a good deal of work was in progress. Steam and electric windlasses, winches, pumps, capstans, cranes, steam steering gears, heaters, condensing plant, projectors, generating plant, &c., for every class of vessel have long been among the products of this firm, which also specialises in the manufacture of colliery power plant and plant for power stations, &c. Some important contracts for marine auxiliaries have recently been secured, and many orders are in hand for the "Woodeson" water-tube boiler fitted with the firm's equipment for burning pulverised coal, including two boilers for the Houghton Main Collieries, one for the Londonderry Colliery, two for Pearce and Partners' Thorne Collieries, and two for the Luton Corporation electricity works. The steam-raising plant at the company's own works consists of a boiler of this type with a coal pulverising equipment, which aroused considerable interest. For considerable periods the plant has been run with coal containing 15 per cent. of moisture, and during the coal strike it was operated with any class of coal that could be obtained. Even when pulverising this wet coal the plant does not take more than 14 to 15 units per ton of coal pulverised. By means of this pulveriser, which is shown in Fig. 11, it is said to be possible to burn the cheapest and lowest grades of coal, containing in some cases as much as 30 per cent. of ash. With pulverisers, economisers and air heaters efficiencies up to 90 per cent. are claimed to be possible. Particular attention is drawn to the fact that in the pulveriser there is only a single disc carrying beaters, and that on opening a door it can be taken out and replaced within a quarter of an hour. A separator is incorporated in the machine, and the fineness of the pulverised coal may be regulated as required. The fan for the primary air, which is an integral part of the machine, draws the fine coal from the separator and discharges the coal and primary air direct to the burners. Provided that hot air is available, no dryer is necessary. Moreover, any tramp iron that will pass through a 1¼in. mesh will do no harm, and a magnetic separator is unnecessary. The external diameter of the main tubes is 3in., and as the tubes are placed practically vertical, in the event of there being any tendency for deposits to be carried over with the gases they do not adhere to the tubes, but fall to the bottom of the ash hopper, where they are removed by an electrically controlled ash-handling plant. It is said to be possible to maintain a very high percentage of CO_2 without fear of slagging. The depth of the combustion chamber is 27ft. The pulverised fuel burners are fitted in the front wall and the fuel, together with the correct amount of air for combustion, is projected in a downward path and is properly burnt. At the bottom of the combustion chamber an air heater

FIG. 9—INTERIOR OF BOILER HOUSE IN "B" SECTION OF THE NORTH TEES POWER STATION

is fitted, and the heated air is used for drying coals that contain more than 5 per cent. of moisture. At the same time this arrangement has the effect of cooling the bottom of the combustion chamber, thus preventing fusion of the ash. An induced draught fan is fitted at the back of the boiler near the chimney base. The boiler is equipped with all the usual instruments, including a CO_2 indicator and recorder, a steam flow meter, water meter and draught gauges, &c. In the case of this works boiler the back nest of tubes is used as an economiser. The results of a test carried out on the works boiler on June 16th, 1926, are given in the table on page 682.

The firm has recently introduced a horizontal header type boiler with a double flow circulation, which provides a definite supply of water to the lower row of tubes. A large proportion of the deposit is precipitated in parts of the boiler more remote from the

fire, with the result that the bottom tubes have a relatively long life. Three boilers of this type, each having a heating surface of 12,000 square feet, are at present on order for the Greenwich power station of the London County Council.

On Thursday evening a dance was held at the Old Assembly Rooms, Westgate-road, when the members were received by Sir Theodore Morrison and Lady Morrison, supported by the Council of the Armstrong College.

What electricity can do in the way of saving time and labour in iron and steel works was admirably

FIG. 10—TURBINE ROOM IN "B" SECTION OF THE NORTH TEES POWER STATION

demonstrated at the Consett Iron Company's works, which were visited on the morning of Friday, June 17th. Some time ago the site of the original mills was entirely cleared and new buildings were erected. Modern electrically-operated plant was installed, the electrical installation being typical of many similar installations for which the English Electric Company has been responsible. The works comprise blast-furnaces, a steel melting shop, rolling mills for plates and sections, engineering shops, test house, &c. There are eight blast-furnaces, seven of which are

Test Figures of Woodeson Boiler.

Duration	4 hours
H.S. of boiler	5200 sq. ft.
Method of firing	Powdered fuel
Calorific value of fuel as fired	10,670 B.Th.U.
Steam pressure by gauge	201 lb.
Temperature, deg. Fah., saturated steam at above pressure	388 deg. Fah.
Final temperature of superheated steam	517 deg. Fah.
Degrees of superheat	129 deg. Fah.
Temperature of gases leaving economiser	380 deg. Fah.
Temperature of feed water to economiser	112 deg. Fah.
Factor of evaporation over plant	1·23
Total amount of water evaporated, actual	123,341 lb.
Water evaporated per hour, actual	30,835 lb.
Total amount of fuel burnt during test	16,380 lb.
Fuel burnt per hour	4,095 lb.
Amount of water, actual, evaporated per lb. of fuel	7·53 lb.
Amount of water, from and at 212 deg., evaporated per lb. of fuel	9·27 lb.
Draught of economiser outlet	·27 w.g.
Average percentages of CO_2 in flue gases	16 per cent.
Efficiency of boiler, superheater and economiser	84 per cent.

55ft. high with a 10ft. hearth, whilst the remaining furnace is 75ft. high and has a 12ft. 6in. hearth. A 7½-ton E.O.T. magnet crane loads pig combs from the pig beds into bogies for conveyance to the pig breakers. In the melting shop, which is 884ft. long, the stock bay is served by three 14-ton E.O.T. magnet cranes, which load pig iron from the pig breaker into charging boxes and lift them four at a time in trays on to the charging platform. Into the same bay scrap from the mills is brought in charging boxes and is similarly handled. There are six 75-ton acid open-hearth furnaces and three 65-ton basic furnaces served by three 3-ton E.O.T. furnace chargers in the charging bay and by three 100-ton E.O.T. ladle cranes in the tapping bay. The furnaces can be fired with producer gas or coke oven gas, each furnace having a "Woodeson" waste heat boiler and induced draught fan. The gas producers, which are of the static water-bottom type with motor-driven "Chapman" agitators, are arranged in two batteries, each composed of nine producers, at the back of the stock-yard bay, and they are served by an inclined railway, which delivers the coal into overhead bunkers. All the ingots are cast on cars and are taken to the stripper houses at the soaking pits of the plate mills and angle mills.

For heating ingots up to 10 tons for the plate mills there are five soaking pits arranged for producer gas or coke oven gas firing. An E.O.T. stripper at one end of the building strips the moulds from the ingots as they are received from the melting shop, and an E.O.T. charger places them in the pits and subsequently transfers them to a tilting chair at the slabbing mill, when the ingots are then delivered by rollers to the 40in. slabbing mill, which is driven by a reversing motor with a maximum output of 14,000 B.H.P. at a speed of from 50 to 120 r.p.m. The slabs produced are cut by steam-hydraulic shears and then charged into six waste heat furnaces to be reheated for either of the two plate mills. The large plate mill comprises two stands having rolls 9ft. 6in. long by 42in. in diameter, and it is suitable for rolling plates up to 9ft. wide by ¼in. to 2in. thick, and it is driven by a motor which is a duplicate of that which drives the slabbing mill. The plates pass through a hot straightening machine to the cooling banks, which are equipped with turn-over gear. From this bank they pass through cross-cut shears, then on to a cold bank, from which some of them are delivered to a side-cut shears served by an "Ennis" plate manipulating table, and the remainder to a side-cut shears with a "Castor" bed. From each of the side-cut shears the finished plates are delivered on to a turntable with live roller gear for turning the plates lengthwise in the loading bay. The light plate mill is of the three-high "Louth" type with rolls 6ft. 6in. long, designed to roll plates from ¼in. thick to ⅜in. thick and up to 6ft. wide, and it is driven at a speed of 52½ r.p.m. through reduction gear in the pinion housing by an induction motor with a maximum output of 5000 B.H.P. at a speed of 240 r.p.m. In the runout from this mill there is a pair of chequer rolls driven by a 1500 B.H.P. motor. The cooling banks and shears for this mill are similar to the equipment at the 9ft. 6in. mill, except for the fact that there is no "Ennis" table at the side-cut shears and all the shears are electrically driven. Throughout the plate mills the manipulators screw-down gear, roll racks, skids, &c., are all electrically driven and controlled by automatic contactor controllers. The loading bay for the plate mills is 620ft. long and is served by three 10-ton E.O.T. magnet cranes of 100ft. span.

For the angle mills there are four soaking pits and the ingots are stripped and charged into the pits by E.O.T. cranes. The ingots, which weigh up to 4½ tons, are delivered by a tilting chariot on to the 36in. cogging mill and cogged down to blooms for either 22in. or 32in. roughing and finishing mills. For reheating the blooms as required there is a bloom reheating furnace which is fired with coke oven or producer gas. All these angle plate mills are steam driven, and the material from them is loaded from the cooling bank by 7½-ton E.O.T. magnet cranes or it is transferred into an adjacent stockyard and finishing bay which is also served by 7½-ton E.O.T. cranes. All the mill auxiliaries are electrically driven. For producing small sections and guide material there is a small bar mill, comprising a 16in. roughing mill driven by a 250 B.H.P. direct-current motor running at from 60 to 120 r.p.m. in tandem with a 12in. finishing mill driven by a 500 H.P. direct-current motor running at 60 to 300 r.p.m., the billets from these mills being heated in a continuous-push furnace fired with coke oven or producer gas.

At the blast-furnace generating station, power is generated from surplus gas from the blast-furnaces and is supplemented by coke oven gas burned under the boilers. The station—see Fig. 14, page 686—contains two 3000-kilowatt turbo-generators consisting of Belliss turbines and English Electric alternators, running at a speed of 2400 r.p.m. and generating three-phase 40-cycle current at 3000/3300 volts at 0·7 power factor. The station runs in parallel with the Cleveland and Durham County Electric Power Supply Company's system, with which it is connected through three 1600 kVA, 3000/20,000-volt transformers. The switchgear is on an upper floor, on which there are also two English Electric 1500-kilowatt rotary converters—illustrated in Fig. 15—which supply current at a pressure of 500 volts to a three-wire system. The general direct-current distribution system throughout the works is supplemented by a 1000-kilowatt English Electric geared turbo-generator set in the turbo-blower house and by a 1500-kilowatt rotary converter in the plate mill sub-station, which also contains the fly-wheel equaliser sets to be seen in Fig. 16 on page 686. This rotary converter is shunt wound, whilst the other two converters are compounded. There is also a 750-kilowatt rotary converter in the blast-furnace sub-station connecting the works sub-station direct-current system with the company's 50-cycle, 5000-volt three-phase colliery system. Alternating 3000-volt current is transmitted to the plate mill sub-station

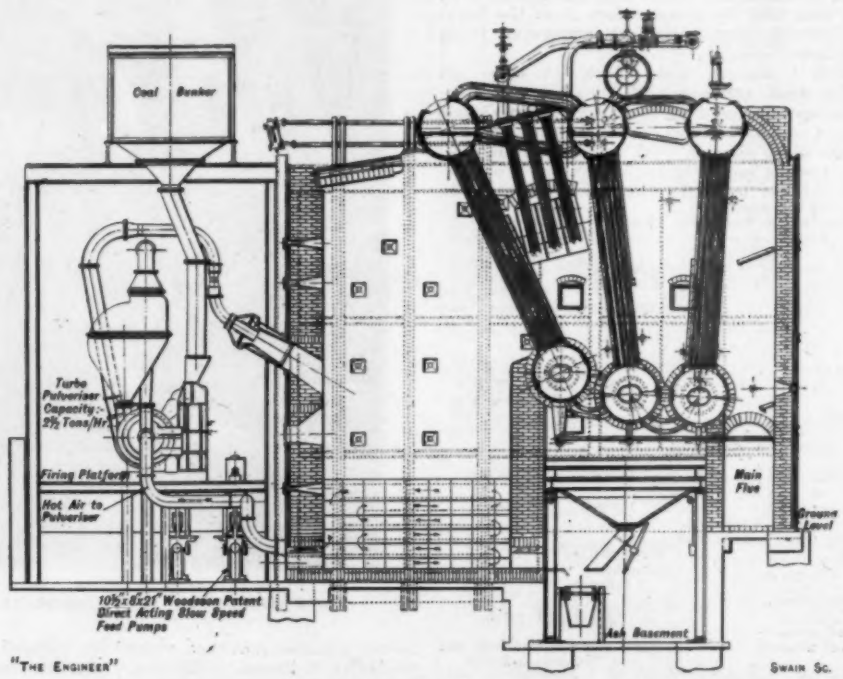


FIG. 11—WOODESON BOILER ARRANGED FOR FIRING WITH POWDERED FUEL

for the principal plate mill units. The connection with the supply company's 20,000-volt system is made in a transformer station about 200 yards distant from the power station, the switchgear being operated on the remote control system from this station.

The 40in. slabbing mill and the 42in. plate mill are both reversing two-high mills and are driven by reversing motors which take their power from two fly-wheel equaliser sets, illustrated in Fig. 16 on page 686, where the large plate mill motor is to be seen in the distance. In the same illustration the incoming 3000-volt switchgear is to be seen on the platform on

the right, whilst below this platform the direct-current distribution board is shown. On the left are the two fly-wheel sets erected in line and coupled together by means of a flexible coupling. The two exciter sets are to be seen below the switchboard gallery, whilst in the foreground there is a view of the slip regulators, which maintain the input to the motors of the fly-wheel sets approximately constant by varying the speed. A small motor generator barring set is placed in the centre of the fly-wheel sets.

Duplicate reversing motors of the double-armature type, as shown in Figs. 18 and 19 on page 686, are employed for driving the slabbing mill and large plate mill, each machine being designed for a peak load of 14,000 H.P. at a speed of 50 r.p.m. and for a speed range of 0/50 r.p.m. at constant torque and from 50/100 r.p.m. at approximately constant horse-power. The weight of each complete motor is 180 tons. The direct-current supply of each of the reversing motors is obtained from an equalising set consisting of a three-phase 2500 H.P. motor driving two variable-voltage generators with a 48-ton built-up cast steel fly-wheel between them. Like the motors, the fly-wheel sets are duplicates of one another and, as already stated, they are arranged in line so that they can be coupled together for greater equalisation of the load, the coupling between the two machines being of a flexible type made by the Wellman Bibby Company and designed to transmit momentary peak loads up to approximatbly 14,000 H.P. The fly-wheel in the centre has its shaft extended in both directions and is fitted with solid couplings to which the armatures of the generators are rigidly bolted. An outer bearing supports the outer end of the armature and the driving motor rotor is rigidly coupled to the armature of the generator with an outboard bearing for the slip ring end. The fly-wheel bearings are lubricated with oil under a pressure of 150 lb. per square inch. Oil pumps belted to the fly-wheel shaft are used while the set is running, whilst motor-driven pumps are employed during the starting and shutting-down periods, and they also serve as a standby in the event of an accident to any of the belt-driven pumps.

The motor driving each of the fly-wheel sets is a three-phase induction machine wound for a pressure of 3000/3300 volts and a periodicity of 40 cycles, and it drives the set at a synchronous speed of 600 r.p.m. The working speed range is between 590 and 470 r.p.m. and the generators, which are connected in series, supply the mill motors. In order to ensure quiet running, the fly-wheels are entirely encased in sheet steel covers and a hand-operated band brake is used for bringing the fly-wheels to rest. The control of the direction and speed of the reversing motors is brought about by the control of the fields of the exciter machines which provide power for the fields of the mill motors and the generators supplying them with power. Each of the exciter sets consist of five machines. The large machine in the centre to be seen under the switchboard in Fig. 16 on page 686 is the synchronous driving motor. The complete exciter set consists of a bucking exciter for the mill motor field, the main exciter for the mill motor field, and the excitation of the other synchronous machines, the synchronous driving motor, giving power factor correction, exciter for the fields of the variable-voltage generators and exciter for the synchronous motor. In the event of the bucking exciter failing whilst in operation, the field of the mill motor is automatically brought back to the full strength, thus preventing the machine attaining an excessive speed, and if the main mill motor exciter fails, it automatically takes the field off the exciter of the variable-voltage generator, thus bringing everything to rest. Similarly any failure of the variable-voltage generator exciter merely has the effect of bringing the mill motor to rest, as it takes all field current off the generators. Synchronous motors for driving the exciter sets were adopted with a view to bringing the power factor of the complete plant, including the two fly-wheel sets, the light plate mill motor, and the chequer mill motor approximately to unity. Each machine can provide approximately 800 wattless kVA, or a total of 1600 volts.

The older method of using quick excitation resistances for reducing the time constant of the mill motors and variable voltage generators, so as to ensure rapid acceleration, has been discarded in favour of special compound windings on the exciters in accordance with the English Electric Company's patented designs, and these windings offer the advantage that the loss of energy in the quick excitation resistances is avoided, with the result that the size of the motor driving the exciter set is reduced by about one-half and in the present instance only 110 horse-power is required.

Limitations of space will not allow us to deal in detail with the switchgear, but it may be mentioned that the direct-current board below the gallery shown in Fig. 16 on page 686 supplies the small motors, which drive pumps, fans, &c. Following the latest English Electric practice, the main controllers for the reversing motors, which work by regulating the exciter fields, are removed from the control platforms in the mill and are placed in the fly-house near the exciter sets. The only connection between the control lever on the mill platform and the controller itself is a single play-pipe filled with alcohol and water solution. This pipe terminates at a diaphragm mounted in the pedestal of the control lever at one end and in a similar diaphragm attached to a rocking valve lever at the controller end. A movement of the control lever displaces the diaphragm from the central neutral position and an entirely synchronous movement takes place on the diaphragm at the controller. Any movement of this nature opens a valve which admits oil under pressure to an operating servo-motor, which, in turn, gives a setting of the controller arm corresponding to the position of the control lever. In order to provide a damping action and at the same time a reserve of power for bringing the controller to the off position in the event of the oil supply failing, the oil under pressure passes through an air vessel on its way to the servo-motor. The supply of oil for the oil pump is taken from a tank, and after circulating through the servo-motor the oil returns to this tank. Under normal working conditions the oil pump is driven by a belt from the fly-wheel set, but a motor-driven pump serves as a stand-by. By making use of oil under pressure for operating the controller, the mill driver is relieved of much physical effort. The operating lever mentioned is mounted on the control platform to be seen in Fig. 17 on page 686, and to the right of this lever there is an instrument desk. When working the control lever the mill driver stands adjacent to the desk and the instruments indicate how much current is flowing into the mill motor, the speed of the motor, and the speed of the fly-wheel set. A red lamp also lights if the speed of the fly-wheel set has been reduced below the lower working limit, whilst stop and start push buttons enable the driver to close a relay circuit, which opens or closes the field of the main exciter, so that the plant can be put into commission or stopped at will. The various master controllers to be seen in the background of Fig. 17 operate contactor gear, which controls the screw-down motors, manipulator gears and live rods.

The barring set for the equaliser sets, to which we have previously alluded, appears at the back of the fly-wheel set shown in Fig. 16 on page 686. Whilst it was considered desirable to have available means for obtaining slow movement on either of the main reversing motors or on the fly-wheel sets, the provision of a barring equipment on each machine would have been somewhat cumbersome, and it was therefore decided to employ a heavy-current low-voltage motor generator set for passing current through the armature of either of the mill motors or any of the variable voltage generators. This current is of sufficient magnitude to give half full load torque with the fields of the machines normally excited and a speed which corresponds to a few revolutions per minute, the barring set being brought into use by plugging it on to the main bars which feed the particular machine to be rotated.

The light plate mill is a three-high "Louth" mill, in which the top and bottom rolls are power driven and the intermediate roll is brought into contact alternately with the top or bottom roll, taking its rotation by friction from the roll with which it is in contact. With such a mill the rotation is always in one direction, so that a continuous running motor can be employed. For this mill a three-phase 2500 horse-power motor, running at 240 revolutions per minute, provides the necessary power, and between the motor and mill there is a 38-ton fly-wheel, whilst a reduction gear combined with the pinions in the pinion housing reduces the mill speed to 60 revolutions per minute. The control pillar for the motor is a standard "truck" type pillar. For starting purposes a liquid starter is employed, and in conjunction with it there is a permanent metallic slip resistance designed for a drop in speed of 10 per cent. from no load to full load, so that the stored energy of the fly-wheel may be utilised on the heavy passes. The 1500 horse-power motor which drives the chequer plate mill is a simple induction machine running at a speed of 240 revolutions per minute, and by means of gearing it drives the mill at a speed of 35 revolutions per minute. Overhung on each side of the pinion of the reduction gear is a 11½-ton fly-wheel, and the energy of these two wheels is brought into play by the introduction of a slip resistance in the rotor circuit of the motor.

FIG. 12—COOLING BANKS

FIG. 13—GENERAL VIEW OF THE MILL

The advantage of direct-current motors for such duties as live rolls, screw-down gear manipulators, mangles, cranes, &c., led to the adoption of these machines throughout the whole of the plant, as well as for similar duties in the angle and bar mills, which have also been reorganised. The type of motor adopted is known as the "mill type" class "M M" motor, specially designed for the heavy duty entailed. The illustration, Fig. 12 on this page, gives a view of the cooling banks with the live roller and skid gear motors in the foreground, whilst Fig. 13 gives some idea of the general lay-out of the mill. In the background on the left there is the building which contains the fly-wheel sets and reversing motors. The two stands of the 42in. reversing plate mill are adjacent to this building, whilst in the foreground on the left is the chequer plate mill, which is in line with the three-high plate mill. On the right-hand side is the part of the mangle for the light plate mill. The extent to which power is used for auxiliary machinery can be gauged from the fact that over 280 motors have been supplied in conjunction with the main equipment.

After the works had been inspected, the members were entertained at luncheon by the Consett Iron Company. As an alternative to the visit to these works, there was an excursion to Hexham and the Abbey, and in the afternoon the two parties met at the Roman Wall and Roman Camp of Borcovicus, where tea was provided by the Homesteads. The meeting was brought to a close by a reception and dance at the Grand Assembly Rooms, Barras Bridge, Newcastle.

South African Engineering Notes.

Large Order for Pipes.

That there are parts of South Africa where the people are prepared to give preference to British goods, even at considerable cost, has just been shown by the large town of Port Elizabeth. The City Council of that port has just placed an order for British cast iron pipes with Guest, Sykes and Chapman, Ltd., engineers and machinery importers, Johannesburg, representing Cochrane and Co., Ltd., of Middlesbrough, who will manufacture the pipes and send them out in special ships. Their price was £76,991, and this exceeded two foreign tenders, one German and the other French, by £9000 as regards the German tender. Under another contract Messrs. Guest, Sykes and Chapman have received, from the same source, an order for numerous special hydraulic needle-type valves, also of British manufacture.

Carbide Factory at Witbank.

The Witbank Power Station, which is now in full operation, although the demands upon it do not call for the use of the three 20,000-kilowatt sets which are installed, is attracting to that locality a number of industries for which cheap electricity is a prime necessity. One of the first to be established is a carbide factory which is now supplying large quantities of its product to various centres in the four Provinces. The raw materials used in the manufacture of the carbide, namely, coke and lime, are obtained from collieries in Natal and lime works in the Transvaal. Thus the railways convey both the raw material and the finished product. The containers in which the finished article is packed are manufactured at the factory from plain sheet iron, and that in itself constitutes an industry, orders having been executed for the supply of containers to other concerns engaged in the manufacture of tar, grease and paint.

Platinum Mining.

The platinum mining industry continues to expand, though fears as to a slump in the price of the metal, should the output be too suddenly increased, has kept several mines from beginning to produce. The three mines which are now producing regularly and on a fairly large scale are the Onverwacht Platinum, Ltd., the Lydenburg Platinum Areas, Ltd., and the Potgietersrust Platinum, Ltd. The Onverwacht milled in April 2322 tons from which, it is estimated, the crude platinum produced will yield 745 oz. of refined platinum and allied metals, equivalent to 6·4 dwts. per ton milled; the Lydenburg Platinum Areas, Ltd., during the March quarter, forwarded 1125 oz. of metallics, of which 1116 oz. have been sold, containing 803·829 oz. of refined platinum group metals, the net realisation therefrom, after allowing for refining, realisation and all other charges after leaving the mine, being £16,000, or £19 18s. 1d. per fine ounce. It is to be noted that there has been a substantial improvement in the working costs of the Onverwacht Mine, which were 36s. 1d. per ton for April, as compared with 41s. 6d. for the December quarter. The profit per ton milled by these mines is about £5 8s. The third producing mine is that of the Potgietersrust Platinum Company, of which the company's technical committee has reported that "for the past quarter 6014 tons of ore were crushed and treated by the flotation process, which produced 85 tons of concentrate valued at 252 dwts. platinoids per ton, of which 38 to 40 per cent. is platinum and the balance palladium. The European analyses of concentrates compare well with local assays in total platinoids, but show a somewhat higher percentage of platinum. With these check assays to hand it is possible to estimate the recovery with some confidence. The daily assays of screen and residue indicated a value for the quarter of 6·72 dwts. and 2·16 dwts. respectively, but the recovery per ton, calculated from concentrates values, is estimated at 3·55 dwts. platinoids, of which 1·35 dwts. are platinum and 2·20 dwts. are palladium. In addition, a rich concentrate containing 50 oz. of platinoids was recovered from the tube mill liner. In base metals the concentrates contain 8·0 per cent. nickel and 3·2 per cent. copper. Treatment of concentrates in Europe is in hand, and the latest information is that no difficulty is expected. A further 100 tons of concentrates have been consigned to England." This company's property contains large quantities of payable ore. In the Vaalkop Zwartfontein and Zwartfontein Central ore bodies alone over 300,000 tons of ore have been developed with a value of approximately 6 dwts. of platinoids, over an average width of 16ft., and further tonnage of the same grade can be developed at will when necessary. Much of the ore in other parts of the property runs 6·4, 7·8 and 9·2 dwts. There is also an enormous tonnage on the property in the Rustenburg district, though development so far finds the values rather under 5 dwts. on the average.

Table Bay Cooling Chambers.

The great development of the fruit industry in the Cape Western districts in the last few years reached such dimensions in 1924, and so much more increase was to be expected in the future, that the Railway and Harbour Administration was compelled to recognise that pre-cooling facilities convenient to Table Bay Harbour (Cape Town) were a vital necessity for the export trade. It was accordingly decided that cool chambers should be erected on the East Pier of the Cape Town Docks, and they were erected and ready for the reception of fruit by the end of December, 1926, the capacity being 4047 tons. The new sheds have two cargo floors at ground level, with two air locks at the back for the reception of fruit, and two floors of refrigerator chambers of a length of 601ft. 4in. The cool chambers are 47ft. 6in. by about 15ft. 6in., and each is capable of accommodating twelve barrows of fruit. The chambers are equipped with 816 barrows, each capable of conveying a load of 4500 lb. weight, and carried by motor-driven traversers. The total quantity of fruit which can be stored in the chambers is:—Shed No. 1, 1685 tons; Shed No. 2, 1515 tons; and the roofed-in gap between them, 108ft. in length, 847 tons. The engine-house is equipped with two sets of high-speed vertical ammonia compressors direct-coupled to direct-current motors. The compressors, cooling batteries and condensers were manufactured by J. and E. Hall, Ltd. Each compressor has a capacity of 120 tons refrigeration. They are single-acting twin cylinder machines, mounted on a closed gas-tight crank case containing the whole motion. One compressor is capable of undertaking the refrigeration of the whole of the pre-cooling stores, the other being regarded as a standby. The engine house is large enough to accommodate a third compressor, and is complete with pumps, switchboard panels, thermometer plant crane, &c. The condensing plant is erected adjacent to the engine-house.

The chambers generally are equipped with five cooling batteries, each of which approximates 8000 lineal feet of 2in. piping. Each battery is furnished with a Sirocco fan, having a diameter of 35in., and capable of handling 25,000 cubic feet of air per minute. Pre-cooling is effected by air being forced over the cooling coils along the main air duct and thence to the cool chamber by means of air ports. After circulating through the chamber, the air leaves through another port situated diagonally opposite to the entry port and returns by the main suction air duct to the cooling batteries. In this manner a continuous current of cold air is kept circulating through the cool chamber at a temperature of 35 deg. Fah. The main air ducts are fitted with "Damper doors" to control the flow of air, and the smaller doors are also provided to regulate the supply to each individual cool chamber. The air locks are also equipped with cooling pipes, consisting of approximately 6000ft. of 1¼in. piping. The cool chambers are insulated throughout with slab and granulated cork. The brick walls of the main building are covered on the inner side with two layers of cork slabs, each of 3in. thickness. The floor of the bottom chamber is laid with 6in. reinforced concrete, 7in. granulated cork, and two ¾in. boarding. The upper chamber ceiling consists of a 3in. top of granulated cork and two layers of 2in. slab cork nailed below. Each chamber is fitted with receiving and shipping doors at either end. The speed with which cargoes of fruit can be loaded into a ship by means of the facilities provided, traversers, barrows, specially designed lifting slings, which pick up barrow and contents and deposit them in the ships, hold, &c., can be gathered from the fact that 20,000 cases—eighteen to the shipping ton—can be loaded into a ship in twenty-four hours. The quantity of fruit exported from Cape Town docks last season was 2,103,428 cases, compared with 1,383,970 cases in the previous season.

Industrial Enterprises Checked.

Some of the unfortunate consequences of the Government scheme for a State-aided steel industry, which were previously anticipated, have now been made public. At the annual meeting of the Union Steel Corporation on May 6th, the chairman stated that in the autumn of 1926 the company had been negotiating with Messrs. Stewarts and Lloyds to erect a tube works at Vereeniging, in conjunction with the company; also with Messrs. Baldwin and Lysaght for the erection of sheet works and galvanising works, at the same place and on the same basis. An agreement was actually signed at the end of December with Messrs. Stewarts and Lloyds, whereas, owing to rumours of the Government scheme and the prospective visit of Messrs. Baldwin's chairman to South Africa in January, no definite decision was come to with Baldwins and Lysaghts. Had there been no Government scheme before the country, the chairman had no hesitation in saying that Baldwins at least would have come to an arrangement with the company. The new Stewarts and Lloyds company should have come into being on April 1st, but it had been postponed until July 1st, so that the Government's intentions can be definitely known. Owing to the present indefiniteness of the Government's attitude with regard to the Union Steel Corporation's industry, the directors have considered it best that the company's cash resources should be conserved, and therefore no dividend was declared.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

THE VACUUM BRAKE IN INDIA.

SIR,—I read with interest the article by an Indian Railway Engineer in your issue of April 29th, 1927.

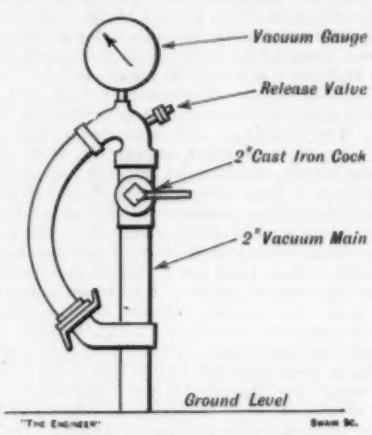
Of the two brakes there is no doubt that a more uniform and gradual application of the brakes throughout a long goods train can be made with the vacuum brake. The practical difficulty met with in getting the vacuum brake to work is, and always has been, the leaky train pipe. This, however, is not insurmountable, and few will agree that such brakes are impracticable.

Tests for leaks in the train pipe have up to recently been entirely neglected in India. Vacuum exhausters are now being installed at most large stations and pipes lead to various test points situated about the goods yards. The majority of these test points consists of nothing more than a swan neck and a hose pipe. Without a stop cock—to shut off the supply, and a vacuum gauge to indicate if the leakage is excessive, after the vacuum supply has been shut off—such test points are useless for testing the train pipe for leakage. In fact, the majority of the staff if asked how to test the brake would say, Create vacuum up to 20in., apply the brake and watch the pistons for 45 mts. This answer is no doubt correct for a test of the vacuum chamber, but ignorance of any test for the train pipe, except the fact that the engine fails to create—maintain—vacuum, is general.

Without such a stop cock and vacuum gauge, the vacuum exhausters, though small, can maintain any amount of vacuum against considerable leakage, whereas a C type small ejector can only maintain 18in. against leakage through a $^{7}/_{32}$in. hole. A Dreadnought small ejector can maintain 18in. against leakage through a $^{5}/_{16}$in. hole, and a super-Dreadnought probably more. In this respect, the vacuum brake companies are producing more and more powerful ejectors, all of which eat more coal without regard to the main cause of the trouble, which we are left to deal with ourselves.

More attention needs to be paid to the production of a reasonably cheap test pipe valve with vacuum gauge complete for testing the train pipe. Leaks in the train pipe are usually due to defective fittings, such as hose pipe clips and couplings and worn out neck rings, but with proper attention at the time of general overhaul there is no reason why these fittings should not run without attention for at least two years. The test has, however, generally been left to the driver of the shunting engine, who takes the rake of vehicles out of shops. The results have been—what might have been expected.

It is therefore essential that a rigid test of the train pipe, as above indicated, with a test point valve and a vacuum gauge complete should be applied to each individual vehicle before it leaves shops. It has been found that the limit of leakage permissible is that the pointer of the vacuum gauge should not fall 5in. in less than one minute. If the train pipe is tight within this limit, the vacuum chamber can usually be left to look after itself, and it is not necessary to watch the pistons for forty-five minutes.



VACUUM TEST POINT VALVE

A rigid test of the vacuum chamber is necessary on ghat (hill) sections, but I think I have said enough to show that it is the lack of a detail in the shape of a cheap test point valve for testing the train pipe which is the chief cause of our present difficulties in working the vacuum brake.

I attach a sketch of a vacuum test point valve as evolved here.

ANOTHER INDIAN RAILWAY ENGINEER.

India, June 2nd.

LAST BEAM ENGINE.

SIR,—In your issue of the 10th inst. appeared a letter from Engineer-Captain Edgar C. Smith, R.N. (Ret.), and in this letter he refers to the last engine of this type as having been built by Messrs. Hick, Hargreaves and Co., in 1884.

As a matter of general interest and in reply to the question raised by the above letter, we beg to inform you that since 1884 James Simpson and Co., Ltd., of London and Newark—whose name is now changed to Worthington-Simpson, Ltd.—have built eleven Beam engines; the last of these was started up in the year 1903 at the Southampton Waterworks, Otterbourne, this being a duplicate of three previous Beam engines that have been supplied to the Southampton Corporation.

It may be stated that all these engines were for waterworks services.

The Southampton engines have high-pressure cylinders 28½in. diameter by 57in. stroke, and low-pressure cylinders 38½in. diameter by 7ft. stroke; arranged to run at a speed of 18 revolutions per minute.

The largest engine installed by James Simpson and Co., Ltd., was that for the Brompton, Chatham, Gillingham and Rochester Waterworks in 1901, at its Luton pumping station; the high-pressure cylinder being 35in. diameter by 5ft. 2in. stroke, the high-pressure cylinder 56in. diameter by 8ft. stroke, arranged to run at a speed of 12 revolutions per minute. This engine was fitted with steam distribution valves and gear of the Corliss type, the valves being arranged in the cylinder covers, and all under the control of the engine governor.

WORTHINGTON-SIMPSON, LTD.

London, June 15th.

PREMIUMS FOR TECHNICAL PAPERS.—We are informed by the secretary of the Society of Engineers that, owing to the generosity of a member of the Society, three special yearly premiums of £10 10s. each have been provided for the classes of members, associate members and associates respectively of the Society, for three years. In each class the premiums will be awarded for the best paper submitted before November 30th, 1927. The donor is of the opinion that many younger members of a technical institution do not write papers because they do not like having to read the paper, consequently he has stipulated that the competitors shall not be required to read their papers in public unless they elect to do so. A long list of suggested subjects in various branches of engineering is being published in the *Journal* of the Society, but, practically speaking, the Council would accept any reasonable subject; competitors should, however, submit titles of their papers to the Society (at 17, Victoria-street, S.W. 1) before starting to write the papers, which should be about 6000 words in length.

THE INSTITUTION OF STRUCTURAL ENGINEERS: ENGINEERING SCHOLARSHIP.—The jury appointed by the Institution of Structural Engineers has awarded the Brenforce Travelling Scholarship—value £300—for 1927 to Mr. J. Blackett, of Newport, Mon., who also receives the Gold Medal. The Silver Medal for the candidate placed second has been awarded to Mr. S. H. Suthers, of Kenton, Middlesex, and the Bronze Medal for the candidate placed third to Mr. E. W. Williams, of London. There were sixty-four entries for the competition, which was for the design of a reinforced concrete water tower and tank. The candidates were originally placed *en loge, i.e.*, kept alone, for twelve hours, during which time they had to make rough sketch designs for the problem, of which they were to the time of sitting, unaware. Subsequently, they had twenty-eight days in which to prepare and submit finished designs, which had to adhere to their original sketches—so the possibility of outside influence might be avoided. Thirty-eight candidates completed the preliminary sketches, and thirty submitted final designs. The designs will be on exhibition at the headquarters of the Institution at 10, Upper Belgrave-street, S.W. 1, till the end of next week.

Railway Matters.

THE 10 a.m. from Euston to Scotland, the 10.40 a.m. to Liverpool, the 11.10 a.m. to Llandudno, the 11.35 a.m. to Windermere, and the 6.10 p.m. to Fleetwood, and the corresponding up trains, are to be known as "The Royal Scot," "The Manxman," "The Welshman," "The Lakes Express," and "The Ulster Express" respectively.

THE late representative in London of the Japanese Ministry of Railways, on the eve of his retirement, entertained a party of British railway officers to dinner, as an appreciation of courtesies frequently shown to him. In responding to the toast of his health, Mr. Jokunaga conveyed an invitation from the Japanese Minister of Railways for a representative body of British railwaymen to visit Japan to see how that country had benefited by British tuition. Mr. Suzumura, his successor, speaking later, said that he hoped that one of his first duties would be to transmit to Japan an acceptance of the invitation.

THE much-discussed proposed non-stop run between Euston and Scotland by the West Coast route is now announced to be from Euston to Glasgow and Edinburgh, with a stop only at Carnforth to change engines. Presumably the train will also be divided there, and the Glasgow and Edinburgh portions run separately thence. The London and North-Eastern is, however, running a train non-stop from King's Cross to Newcastle. The present record is held by the Great Western from Paddington to North-road, Plymouth, 225¾ miles. Whilst Carnforth is 236 miles from Euston and Newcastle 268½ from King's Cross.

THE Ministry of Transport railway statistics for the month of March last have recently been issued as a Stationery Office publication, price 3s. 6d. They show that the number of passenger journeys decreased, when compared with March, 1926, by 5·5 per cent., and the receipts therefrom by 10·8 per cent. Moreover, the passenger train miles were 0·6 per cent. more. Passenger receipts of every kind decreased by 8·6 per cent. There was only a small decrease—one of 1·3 per cent.—in the tonnage carried, and, owing mainly to the advance in some rates made on February 1st, the freight receipts increased by 2·9 per cent. That the rate of movement was slower is indicated by the net ton-miles per engine hour falling from 439¼ in 1926 to 429 in 1927.

A CONCESSION has been granted by the Spanish Government for the construction of a line of railway from the harbour of Alicante—recently much improved—to Alcoy, an important industrial town in a fertile district. The new line will compete with the highway to Alicante, one of the best in southern Spain, leading to the south-west through the valley of the Serpis and crossing the Sierra-del-Corbo with a length of 34 miles. The cost of the new line is placed at 30,000,000 pesetas. As the concessionnaire will shortly be inviting tenders for part of the rolling stock, a quantity of steel rails and other supplies, British firms might address their inquiries, written in Spanish, to the Concessionnaire of the Alcoy–Alicante Line, care of the British Vice-Consul, Señor José Tato, Alicante.

SUPPLEMENTING our reference in this column on the 3rd instant to the report by Lieut.-Colonel Hall on the collision of November 24th at Gale-street, on the Tilbury section of the London, Midland and Scottish Railway, we would say that the report observed that both trains were partially fitted with the auxiliary shock-absorbing type of buffers, and that they appeared to have acted well. The buffers in question were illustrated in a supplement to THE ENGINEER of December 5th, 1913, when, as a sequel to the Ais Gill collision of September 2nd, 1913, we described the bogie stock used on the Midland Railway. The arrangement is that of George Spencer, Moulton and Co., Ltd., and consists of two nests each of nine concentric rubber springs, which come into play after the ordinary buffer springs have been driven up to the working limit. Mr. Bain, the then carriage and wagon superintendent of the Midland Railway, stated at the Board of Trade inquiry into the Ais Gill accident—when sixteen passengers were killed—that had the carriages been of the new type and fitted with the new kind of buffer the passengers would have got out of the accident with nothing worse than a severe shaking, as the improved equipment would resist a blow up to 40 m.p.h.

IN our leading article of the 10th instant on the subject of continuous brakes for goods trains there were occasional references to a Berne Convention and to a Berne International Commission. That body, actually, is L'Unité Technique des Chemins de Fer, and its origin, purpose and achievements were described in an article on page 580 of THE ENGINEER of December 18th 1914. As in other matters affecting all the continental countries in general, Switzerland took the lead, and in October, 1882, the Swiss Federal Council sought the various Governments to agree to a conference to secure such uniformity in rolling stock, both passenger and goods, as would allow for the free circulation of wagons, carriages and locomotives over any of the railways of the Continent. As long ago as 1886 there were being discussed questions, that affected all countries in common, such as a standard loading gauge, the maximum length for rolling stock, and a maximum wheel base. In 1907 there were under consideration such matters as the lighting of trains, the direction in which windows and doors should open and vestibule connections for corridor coaches. The loading gauge dimensions, maximum lengths of vehicle and of wheel base were agreed to in 1912. The question of continuous brakes for goods trains actually was started by the German Railway Union, independently of L'Unité Technique, in 1903, and did not come before the latter body until its third conference, mentioned above, in 1907. As a result a sub-committee was appointed to make experiments and to draw up the requirements for a standard automatic continuous brake for goods trains. In 1911 the main body approved of the recommendations of that committee, and the last official action of L'Unité Technique was to conduct experiments with the Clayton-Hardy vacuum brake in Austria in September, 1912, and with the Westinghouse brake in Hungary in September and October, 1913.—All tests made since have been by the French Government alone or by the International Union of Railways—a post-war body.

Notes and Memoranda.

A LARGE broadcasting station is being erected at Zeesen to supersede the present station at Königswusterhausen. From all accounts, Zeesen will outpace Langenburg as well as Daventry. The power of the new transmitter will be 35 kilowatts, *i.e.*, four times that of Königswusterhausen, and use will be made of Telefunken water-cooled transmitting valves rated at 20 kW, such as are already used at Langenburg. The wave-length will remain at 1250 m., and, as in the case of Königswusterhausen, the modulation will be carried out at Berlin.

THE Swedish ironworks have decided to extend the collaboration in technical research work which was organised last year by appointing four committees for scientific research work on different technical problems connected with the production of iron and steel. It is planned to organise a common technical council, and all the big ironworks, with one exception, have declared themselves willing to contribute to the cost by paying 20 oere for every ton of ingots and blooms produced and 10 oere per ton of pig iron exported. A large sum should therefore be available for scientific research.

A SITE for an experimental plant for manufacturing paper pulp in Tasmania has been selected, and a start will be made on the foundations almost immediately. The capacity of the proposed plant is such that it will manufacture a ton of newsprint a day and wind it on a reel 30in. wide. This small plant is a forerunner of a 100-ton plant, which is the objective of the company. It is to be used experimentally, so that no mistakes will be made in the design of the large plant, which is to cost about £1,500,000. The number of employees of the mills, when in operation, will be about 800. The experimental plant will be situated near the mouth of the Kermandie River.

IT is reported that the paper expert of Baroda State (Bombay) has succeeded in his experiments for the production of a high quality paper out of the bamboo grown in the forests of the State. He has also shown distinct reduction in the "unit cost" of pulp, having reduced the quantity of bleaching powder required. It is expected that the State will shortly establish a factory for the manufacture of paper of this quality. The prospects of this venture are said to be very good, since the total estimated cost per ton hardly amounts to 100 Rs., leaving a sufficient margin for the initial expenses, while paper of the same quality imported from Norway and Sweden costs from 125 Rs. to 225 Rs. a ton with additional charges for freight in India.

THE new Ashton mechanical iron puddling process, controlled by the A. M. Byers Company, is now being tested at the works of the American Puddled Iron Company, near Youngstown, O. It is stated that the big squeezers, which are the substitute for hand puddling and the feature of the new process, making "balls" weighing a ton or more, are working satisfactorily. There have been minor problems with the blooming or breakdown mill which does the initial rolling of the puddled ironball. However, they are said to be mere rolling mill questions which will be readily solved. The success of mechanical puddling on the scale possible in the Ashton process is considered locally to be the most important step in the iron and steel industries since the introduction of the Bessemer steelmaking process.

IN reply to a question as to the present state of the shipbuilding industry, it was recently stated in the House of Commons that the tonnage under construction for Great Britain and Ireland at the end of the March quarter of 1927 was 1,217,000 gross tons, as compared with 843,000 tons and 1,165,000 gross tons at the end of the corresponding quarters of 1926 and 1925 respectively. Tonnage commenced during the March quarter was 580,000 gross tons, as compared with 193,000 gross tons and 202,000 gross tons in the corresponding quarters of 1926 and 1925 respectively. Complete information as to orders placed abroad was not available, but there was nothing to indicate that in respect of such orders there had been any marked difference between the past six months and the corresponding periods of the two preceding years.

THE importance of analysing underground waters encountered in the course of oil-drilling operations, as a means of determining the source from which these waters come, is stressed by the United States Bureau of Mines, in a technical paper by Mr. C. E. Reistle, jun. Water in the formations penetrated by an oil well hampers the production of crude oil in many ways. This water may be in the oil sand itself or in separate formations above or below the one that is oil bearing. Water decreases the productiveness of an oil sand, increases lifting costs, and at many wells forms emulsions with the oil. Although it is impossible to eliminate the "edge water" that occurs naturally in the oil sand, it is frequently possible to prevent other waters from entering the productive strata. In order to accomplish this successfully, one usually has to identify the water and discover the stratum from which it is coming. In the paper mentioned detailed information with regard to the identification of oil-field waters by chemical analysis is given.

THE results of an interesting series of experiments in connection with several new industries have been published in a report of the Department of Industries of Mysore State. A scheme is being investigated for the utilisation of the by-products of the Mysore Ironworks for the manufacture of preservatives for wood and iron. It is stated that a sample of this product is very favourably reported on by consumers. The industrial chemist is also engaged in the manufacture of a new type of flooring, utilising sawdust in association with certain chemicals. Attention has been given to the manufacture of a carding machine for the conversion of silk waste into spun silk. The experiment is said to have had encouraging results. Another line of investigation concerns tests of the quality of the emery which occurs on Chamundi Hill in the capital of the State with the view of determining its suitability for manufacturing purposes. The superintendent of industries, Mysore Division, who is in charge of this scheme, reports that the emery is suitable for facing the cones of the rice mills in Mysore, for which there is a demand to the value of 30,000 Rs. a year.

Miscellanea.

THE Swedish Minister of Commerce, in a recent interview, is reported to have stated that measures in support of the Swedish iron industry were being prepared by the Government. In the first place, he said, a committee of inquiry would be appointed.

IT has been decided by Pirelli, Ltd., to build a factory for the manufacture of tires of the pneumatic, semi-pneumatic and solid types. In all probability, the new works will be constructed near to the two firm's cable factories at Eastleigh and Southampton.

ESTIMATED to cost £175,000 a year, a scheme for the establishment of a Colonial scientific and research service has been approved of by the Colonial Office Conference. The scheme applies to the non-self-governing Dependencies, including Colonies, Protectorates, and Mandated Territories.

THE Paviors' Company has received an intimation from the Associated Portland Cement Manufacturers, Ltd., and the British Portland Cement Manufacturers, Ltd., that each of these companies has voted £1000 towards the fund now being raised by the company for the establishment of a Chair of Highway Engineering at London University.

IT is announced from Bogatá that an agreement has been concluded between the Pacific Railway and a Swedish engineering firm for improvements at Buenaventura harbour, the most important Colombian port on the Pacific and the *entrepôt* for the rich Cauca Valley. The region is subject to heavy rainfalls, and special protection will have to be made against damage by floods.

ACCORDING to recently published official statistics for last year, the production of iron ore in South Australia was maintained satisfactorily at 583,745 tons, the only year showing a greater tonnage being 1925; the figures for last year are less than 3000 tons below those for the year before. The total value of the mineral production was £1,032,353, a little greater than that of £1,028,471 for 1925.

HULL trawlers which are proceeding to Greenland to explore new fishing grounds are being equipped with wireless telephone apparatus. Experimental tests were recently successfully carried out by two ships, one lying off Grimsby, and the other berthed in St. Andrew's Dock, Hull. The Marconi Company is responsible for the installations. Ships proceeding to the Davis Straits in quest of halibut, will be able to keep in telephonic communication with each other over a wide area.

THE Liverpool Overhead Railway will soon be supplied with electric power from the Liverpool Corporation. The change over will take place on Sunday, June 26th, when the railway company's generating station will be closed down, and direct-current at 520 volts will be supplied from three sub-stations of the Corporation. The railway is now open for traffic on Sundays from 2 p.m. to 10.30 p.m., and on week-days from 6 a.m. to 11 p.m. Special facilities are offered to the public to see the new Gladstone Docks, to be opened by the King next month.

WORK is reported to have been commenced on what, when it is completed, in February next, will be the world's largest single working elevator constructed in one unit, for the United Grain Growers of Canada. This elevator will have a 5,500,000 bushel capacity, and will cost £400,000. It will have a frontage on Thunder Bay of 600ft., and a depth of 1400ft. The building will be of all-concrete construction, and will consist of a work plant and 500 concrete storage tanks. A dock 1000ft. long, adjoining the elevator, will also be built.

THE Baskatong storage reservoir on the Gatineau River, in the Province of Quebec, will be the third largest in the world. The natural water area there is only 20 square miles, but it will be increased to about 115 square miles by the construction of the Bitobec Dam, which will impound 95 thousand million cubic feet of water, as compared with the Gouin Reservoir, the world's second largest, also in Quebec, storing 150 thousand million cubic feet, and the Gatun, Panama Canal, with 183 thousand million cubic feet of storage. Baskatong Lake will be raised 55ft.

THE Metropolitan Water Board proposes to install electrically driven centrifugal pumps in duplicate at the Hampton works, each capable of pumping 5,000,000 gallons per twenty-four hours. The cost of installing two new electric generators with new motors, cables, &c., where necessary and replacing the existing Sheffield engines by electric pumps is estimated at £9000, while the saving in wages would be over £1000. It is also suggested that the pumps at the Sunnyside engine house, Hampton, should be superseded by electrically driven pumps at a cost of £500.

A REPORT from Brussels states that the body known as the "Great Works Committee" recommends the construction of a direct Liége–Antwerp Canal—not passing through the Maestricht enclave—so as to free traffic from the restrictions placed on the present canal where it passes through foreign territory. At the same time, it is hoped that with the direct canal there would come an increase in the through traffic from the basins of the Meuse and Moselle, Alsace-Lorraine, and the North-East of France. The Committee likewise recommends that work for the improvement of existing canals should be commenced so soon as possible.

THE Governor of the State of Rio de Janeiro has granted a concession, and the necessary preliminary funds have been raised, for the construction of port works at the Bay of Angra dos Reis. These improvements will be supplementary to those to be undertaken at Paraty, a small port on the west side of the same bay, thus promoting the interests of the numerous coffee, cereal and fruit producers in the neighbourhood. Angra dos Reis, which is served by the Central Railway, is 90 kilms. from Rio de Janeiro, with which it is now proposed to link it further by means of the Oeste-de-Minas Railway through its recently completed extension to Jussaral. The works form part of the comprehensive scheme adopted to improve the port of Nichteroy, and to enable vessels engaged in the coastal trade to come closer in.

ELECTRICAL EQUIPMENT AT THE WORKS OF THE CONSETT IRON CO., LTD.

THE ENGLISH ELECTRIC CO., LTD., LONDON, ENGINEERS

(*For description see page 680*)

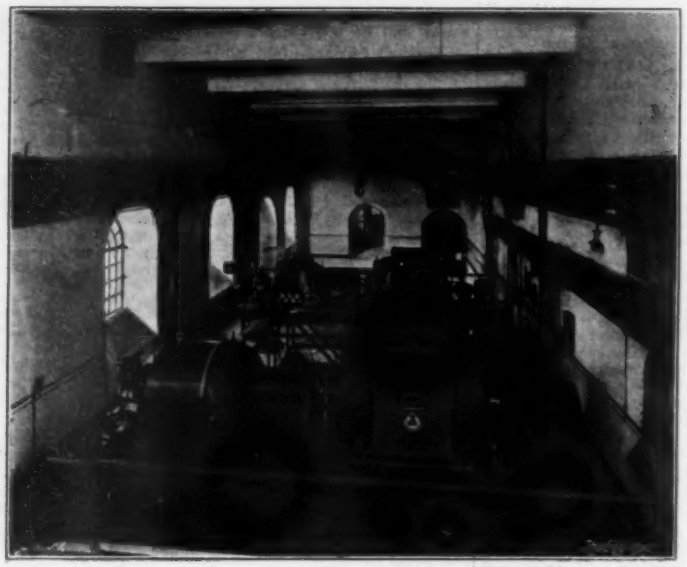


FIG. 14—POWER PLANT

FIG. 15—1500 K.W. ROTARY CONVERTERS

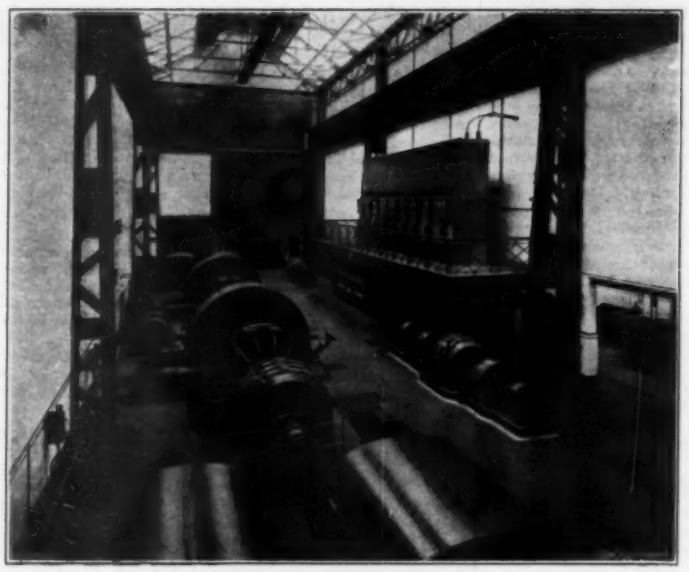


FIG. 16—EQUALISER SETS

FIG. 17—CONTROL PLATFORM

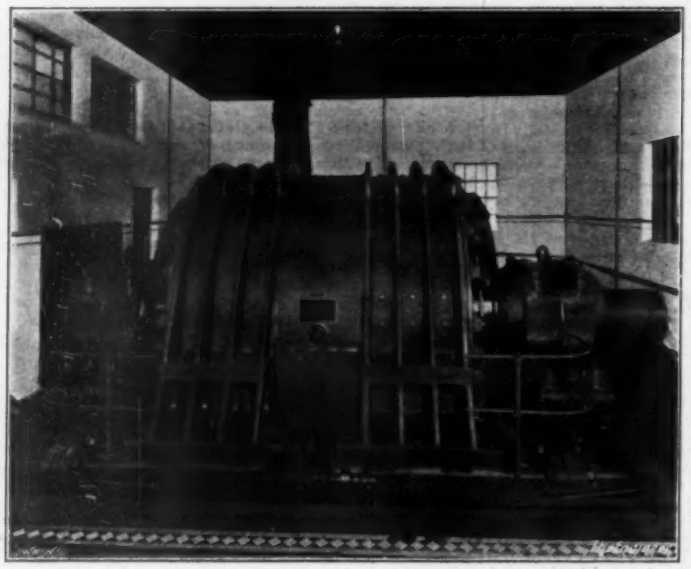


FIG. 18—14,000 H.P. REVERSING SLABBING MILL MOTOR

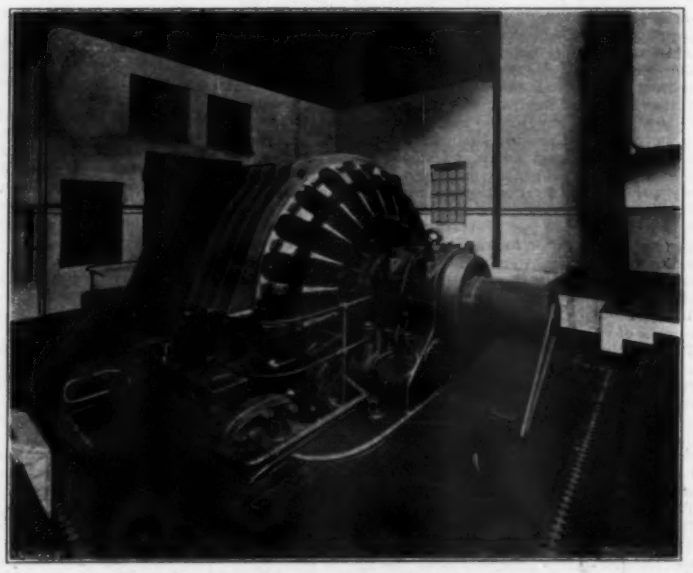


FIG. 19—14,000 H.P. REVERSING PLATE MILL MOTOR

AGENTS ABROAD FOR THE SALE OF

The Engineer

BUENOS AIRES.—Mitchell's Book Store, 576, Cangallo.

CHINA.—Kelly and Walsh, Limited, Shanghai and Hong Kong.

EGYPT.—Cairo Express Agency, near Shepheard's Hotel, Cairo.

FRANCE.—Boyveau and Chevillet, Rue de la Banque, Paris. Chapelot and Cie., 136, Bld. St. Germain, Paris.

GERMANY.—Fritz Rehfus, Blumenthalstrasse, 10, Cologne.

BELGIUM.—W. H. Smith and Son, 78/80, Rue du Marché-aux-Herbes, Bruxelles, and 44, Rue Joseph II., Ostend.

INDIA.—A. I. Combridge and Co., Bombay; Thacker and Co., Limited, Bombay; Thacker, Spink and Co., Calcutta.

ITALY.—Maglioni and Strini, 307, Corso, Rome; Fratelli Treves, Corso Umberto 1, 174, Rome; Fratelli Bocca, Rome; Ulrico Hoepli, Milan.

JAPAN.—Maruzen Co., Tokyo and Yokohama.

AFRICA.—Wm. Dawson and Sons, Limited, 7, Sea-street (Box 49), Capetown.
C. Juta and Co., Johannesburg, East London, and Grahamstown.

AUSTRALIA.—Gordon and Gotch, Limited, Melbourne, Sydney, Brisbane, and Perth, &c.
Melville and Mullen, Melbourne.
Atkinson and Co., Gresham-street, Adelaide.

CANADA.—Dawson, Wm., and Sons, Limited, 87, Queen-street East, Toronto.
Gordon and Gotch, Limited, 132, Bay-street, Toronto.
Montreal News Co., 386-388, St. James-street, Montreal.
Toronto News Co., 42, Yonge-street, Toronto.

CEYLON.—Wijayartna and Co., Colombo.

JAMAICA.—Educational Supply Co., Kingston.

NEW ZEALAND.—Gordon and Gotch, Limited, Wellington and Christchurch; Upton and Co., Auckland; J. Wilson Craig and Co., Napier.

STRAITS SETTLEMENTS.—Kelly and Walsh, Limited, Singapore.

UNITED STATES OF AMERICA.—International News Co., 83 and 85, Duane-street, New York; Subscription News Co., Chicago.

SUBSCRIPTIONS.

The Engineer can be had, by order, from any newsagent in town or country, at the various railway stations; or it can, if preferred, be supplied direct from this office.

Half-yearly (including index number) .. £1 12s. 6d.
Yearly (including two index numbers) .. £3 5s. 0d.

If credit occur, an extra charge of two shillings and sixpence per annum will be made.

Foreign Subscriptions will be received at the rates given below. Foreign subscribers paying in advance at these rates will receive The Engineer weekly and post free. Subscriptions sent by Post Office Order must be made payable to The Engineer and accompanied by letter of advice to the Publisher.

Thin Paper Copies.		Thick Paper Copies.	
Half-yearly ..	£1 11s. 6d.	Half-yearly	£1 13s. 9d.
Yearly	£3 3s. 0d.	Yearly	£3 7s. 6d.

(The difference to cover extra postage.)

Canadian Subscriptions—
Thin paper edition .. .. £2 18s. 6d. per annum.
Thick paper edition .. £3 3s. 0d. „

*** Reading Cases, *to hold two copies of* The Engineer, *cloth sides and leather backs, can now be supplied at 4s. 9d. each, 5s. 3d. post free.*

ADVERTISEMENTS.

*** The Charge for Situations Open and Wanted Advertisements of four lines and under is four shillings, and one shilling per line for each additional line up to one inch. When an advertisement measures an inch or more the charge is twelve shillings per inch. The rates for all other classes of advertisements, other than those mentioned above, are included in "The Engineer Directory," which is sent post free on application. All single advertisements from the country must be accompanied by a remittance in payment. Alternate advertisements will be inserted with all practical regularity, but regularity cannot be guaranteed in any such case. All except weekly advertisements are taken subject to this condition.

Small Advertisements cannot be inserted unless delivered before TWO o'clock on Thursday afternoon (the day before publication). ALTERATIONS to STANDING ADVERTISEMENTS must arrive not later than THURSDAY of the week preceding publication.

Letters relating to the Advertisement and the Publishing Department of the Paper are to be addressed to the Publisher, all other letters to be addressed to the Editor of The Engineer.

THE ENGINEER DIRECTORY.

This Directory, which is published annually in the interests of advertisers in The Engineer, may be obtained free of charge on application to the Publisher.

"THE METALLURGIST"—BINDING CASES.

Cloth Binding Cases for twelve issues (one year) .. .. 2s. 0d.
Subscribers' own copies, including cases, bound Cloth .. 4s. 0d.
Bound half roan 7s. 6d.

Postal Address, 33, Norfolk-street, Strand, W.C. 2.
Teleg. Address, "Engineer Newspaper, Estrand, London."
Telephone Nos. Central 2256, 2257.

PUBLISHER'S NOTICES.

*** *With this week's number is issued a Special Sixteen-page Supplement,* The Metallurgist. *Every number, as issued by the Publisher, contains a copy of this Supplement, and Subscribers are requested to notify the fact should they not receive it.*

*** *If any Subscriber abroad should receive* The Engineer *in an imperfect or mutilated condition, he will oblige by giving prompt information of the fact to the Publisher, with the name of the Agent through whom the paper is obtained. Such inconvenience, if suffered, can be remedied by obtaining the paper direct from this office.*

TO CORRESPONDENTS.

*** *All letters intended for insertion in* The Engineer *or containing questions should be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

*** *We cannot undertake to return drawings or manuscripts; we must therefore request correspondents to keep copies.*

By arrangement with Reuter's Engineering Service, The Engineer *contains the latest news from all parts of the world which is likely to be of interest to engineers.*

Contents.

The Engineer, June 24th, 1927.	PAGE
A Seven-day Journal	675
Uniflow Marine Engine with Oil-operated Valve Gear. (Illus.)	676
Centenary of the First Railway in France. (Illus.)	679
Institution of Electrical Engineers' Summer Meeting. No. II. (Illus.)	680
South African Engineering Notes	684
Letters to the Editor—	
The Vacuum Brake in India	684
Last Beam Engine	684
Railway Matters—Notes and Memoranda—Miscellanea	685
Leading Articles—	
The Naval Limitation Conference	687
The Right of Continental Railwaymen to Strike	688
Centenary of the Shaws' Water Company's Works. (Illus.)	688
Books Received	689
The Siemens-Benson Critical-pressure Boiler. (Illus.)	690
Theory and Practice	691
National Federation of Iron and Steel Manufacturers	691
A New Sheet Edge Grinding Machine. (Illus.)	692
Balancing Gear for a Four-cylinder 250 B.H.P. Oil Engine. (Illus.)	692
Telegraph and Telephone Wires	692
Port Improvements in Colombia	692
A Joint Meeting of Institutions of Engineers and Shipbuilders	693
Sixty Years Ago	693
A Chain Pulling Jack	694
A New Rotary Pump. (Illus.)	694
Loading Reactances for Large Generators. (Illus.)	694
Provincial Letters—	
The Midlands and Staffordshire—Lancashire	695
Sheffield—North of England—Scotland	696
Wales and Adjoining Counties	697
Personal and Business Announcements	697
Launches and Trial Trips	697
Catalogues	697
Current Prices for Metals and Fuels	698
French Engineering Notes	699
British Patent Specifications. (Illus.)	699
Forthcoming Engagements	700
Contracts	700

Sixteen-page Supplement—"The Metallurgist."

The Metallurgist

THE JUNE NUMBER OF THE MONTHLY METALLURGICAL SUPPLEMENT TO "THE ENGINEER" ACCOMPANIES THIS ISSUE.

THE ENGINEER.

JUNE 24, 1927.

The Naval Limitation Conference.

The Conference between the British Empire, the United States, and Japan for the further limitation of naval armaments opened at Geneva on Monday, when each of the Powers submitted proposals designed to achieve the object in view. The most detailed and, to our mind, most practical plan was that unfolded by Mr. Bridgeman on behalf of the British Empire. Its main provisions may be summarised as follows:—(1) Extension of the "life" of capital ships to twenty-six years and a reduction in the "standard" displacement of such vessels as may be laid down in the future; (2) revised displacement limits for non-capital ships, viz., 7500 tons for cruisers, 1750 tons for flotilla leaders, 1400 tons for destroyers, 1600 tons for "overseas" submarines, and 600 tons for boats of the coastal class; (3) maximum gun calibres to be fixed at 13·5in. for capital ships, 6in. for aircraft-carriers and cruisers, and 5in. for all other craft, including submarines; (4) acceptance of the existing ratio of 5 : 5 : 3 for cruisers of 10,000 tons, armed with 8in. guns, the number of such ships required by each of the three Powers to be made the subject of negotiation; (5) a numerical limitation of submarines based upon national requirements. The effect of the first proposal would be to defer the replacement of capital ships beyond the dates specified in the Washington Treaty. Under that agreement, the British Empire will be entitled to lay down two capital ships in 1931, the United States two, and Japan one. But if the "life" of existing vessels is to be lengthened by five years, the necessity for replacement would not arise until a later period. A substantial saving in expenditure would thus be effected without prejudice to the present scale of relative strength. Further, by reducing the displacement of new ships to 30,000 tons, as against the 35,000-ton Treaty figure, the cost of each vessel would be considerably reduced. As armament is a determining factor in the weight of a ship, the substitution of 13·5in. for 16in. guns would simplify problems of design, nor is it to be doubted that guns of 13·5in. calibre satisfy all reasonable requirements as to range and striking power. The restriction of future cruisers to 7500 tons is a thoroughly sensible proposal. We have always held that a mistake was made at Washington in establishing a maximum of 10,000 tons for cruising ships. At that time the great majority of cruisers in service were below the 6000-ton mark, their armament consisting of 6in. or 5·5in. guns, and it was never suggested that they were inadequate in size or fighting power. But as soon as the standard of cruiser tonnage was raised, each country hastened to design ships of the maximum displacement permitted. As a consequence, all the leading navies are now building cruisers of 10,000 tons, armed with 8in. guns, and ranging in cost from £2,000,000 to £3,000,000 per ship. No country has gained an advantage by this development, and it is high time that it was arrested. The limits proposed for torpedo craft and submarines are also ample. Of late years there has been a marked tendency abroad to force the pace in dimensions. Flotilla leaders now under construction in France will have a displacement exceeding 3000 tons at full load, and the new destroyers will approach 2000 tons. If this sort of thing continues we shall be compelled in self-defence to build leaders and destroyers of equivalent weight and fighting power. It is, however, a futile and extravagant process which in the long run benefits nobody, least of all those nations which can only afford a very limited expenditure on naval armaments.

As will be observed, the British Empire has signified its readiness to accept the 5 : 5 : 3 ratio for cruisers of the heaviest type. If this formula is translated into practice the Empire, with its wide-spread and vital sea interests, will be reduced to bare equality in capital ships, aircraft-carriers, and heavy cruisers with the United States, a country which is practically invulnerable to naval attack and in no sense dependent upon ocean trade for its existence. We hope the full magnitude of this concession on Britain's part will be appreciated in Washington. It has long been evident that American insistence on naval equality with the British Empire is due to political motives, and not to strategic necessity. In other words, America values the political influence and the prestige conferred by a great navy, and is apparently prepared to pay the price for what is, in her case, an appanage *de luxe*. We shall not quarrel with her on this account provided she does not expect us to conform to a standard of naval strength framed to suit her own convenience. It will be noticed that the British proposal for equality with the United States does not cover cruisers of the 7500-ton class. Such vessels are designed primarily for commerce protection, and the Admiralty evidently feels that in this class we are entitled to a margin of supremacy, owing to our enormous volume of sea traffic, the length of our communications, and the disastrous results that would follow a successful attempt to dispute our control of the arterial routes. We hope that the Admiralty, having taken up this position, will stoutly maintain it. The British peoples are prepared to go to any reasonable lengths to secure the goodwill of their American cousins, but even in pursuit of this laudable aim they cannot afford to jeopardise their very existence, as they would be doing if they consented to reduce their naval defences below the minimum which experience has shown to be essential. It remains to be seen whether the United States will accept our claim to preferential treatment in the matter of light cruiser tonnage or adhere to its demand for a rigid "fifty-fifty" formula in every type of ship. In the latter event we fear that the Geneva Conference will prove abortive. It is an ominous sign that influential voices in America should already be heard predicting the consequences of failure. The Chairman of the House of Representatives Naval Committee declared on Tuesday that a failure to reach agreement "would be followed by a resumption of competition in naval building and the passing of a Bill for ten new 10,000-ton American cruisers already recommended." To make the hint more pointed, he added: "With £100,000,000 Treasury surplus in hand, the question for Congress would be whether reduction of taxation is more important than national defence." We do not need to be reminded that America, with her superior wealth, could build two warships to our one if she were so disposed. But it is by no means certain that the taxpayers of America would consent to finance a naval programme which would be demonstrably out of proportion to the requirements of national defence and calculated to revive the spirit of competition in armaments which America has so loudly condemned.

Apart from the vexed question of ratios, the present Conference has an opportunity of furthering the cause of naval limitation by accepting the British proposals for tonnage reduction. These proposals have a deeper significance than may be visible at first glance. *Mutatis mutandis*, every reduction in the displacement of a fighting ship

involves a reduction in its radius of action. Thus a battleship of 35,000 tons would be more formidable as an instrument for overseas warfare than one of 30,000 tons, irrespective of the difference in armament. This point is one of cardinal importance in view of the intention avowed by America at the Washington Conference of promoting peace by restricting the range of naval weapons. It is generally agreed that the most important achievement at that Conference was the banning of new insular fleet bases in the Pacific. Thanks to this measure, the possibility of rival fleets coming within fighting reach of each other in the Pacific Ocean has been almost eliminated, and to that extent the risk of war is appreciably reduced. The next and most obvious stage in the process is to establish a lower standard of tonnage for each type of combatant vessel. Japan is in sympathy with the British recommendations on this point, and we do not see how America can consistently oppose them. To argue, as some of her experts are doing, that her strategic problems are such as to demand large battleships and cruisers capable of conducting oversea operations, is to stultify all the professions upon which the American case for disarmament is founded. If the British Empire with its incomparably greater naval commitments is willing to accept a lower standard of tonnage in future ships, surely the United States need not hesitate to do so. Many other points in the various programmes unfolded at Geneva call for consideration, not least the Japanese suggestion that a security pact should be entered into by the three nations, but discussion of them must be reserved for a subsequent issue.

The Right of Continental Railwaymen to Strike.

THE difficulties of reconciling principles of individual and collective liberty with social duties are nowhere more clearly shown than when a body of men decide to paralyse an essential public service as a means of securing some object upon which they have set their hearts. That personal freedom of action must be limited by considerations of public welfare is a fundamental tenet of socialistic doctrine, yet, curiously enough, it is in circles where that doctrine is most widely disseminated that we find the greatest reluctance to admit the rights of the public to protect, by the organised power of the State, their means of transport, communication, and other essential services. In a democratic country, a strike for a political object stands self-condemned, for it is an attempt of a minority to coerce a Government elected by the majority. If the object is economic, such as the revision of wages or conditions of labour, the rights of the public equally forbid a cessation of vital services, and, above all, when machinery exists for an impartial decision upon the points in dispute. Labour organisations, however, are loath to abandon their claim to employ the strike as a weapon of industrial warfare, even though it becomes every day more devastating to themselves and to their fellow-citizens, as civilisation makes the members of the community more interdependent. When the Renkin Bill for the "industrialisation" of the Belgian State Railways was under discussion some years ago, the clause that excited the most violent opposition of the railway unions was one which would have made it compulsory in the last resort, that every dispute should be settled by the verdict of a court of arbitration. The walls of Brussels were then placarded with bills urging all organised workmen to unite in opposition to such tyranny. It was in vain that the Minister pointed out that every dispute, sooner or later, had to be settled somehow, and that it was much more sensible to get questions regulated at once by an impartial tribunal than it was to have a preliminary strike, which would impoverish the men and inflict injury on the whole community, before coming to a decision. That the common-sense view of the Minister would, ultimately, have prevailed is unlikely, but, in any event, the Belgian Railway Act of last year by which the railways were put under the management of a company, controlled by the State, contains no clause rendering a railway strike illegal.

The refusal of many European countries in which the railways are State owned, to permit the organisation of trade unions among the railway workers is undoubtedly a measure of protection against strikes. In the case of company-owned undertakings, such precautions on the part of a Government are neither necessary nor desirable, for the Government, as such, stands above and outside any dispute, free to act impartially if intervention is called for. With State ownership, on the other hand, the Government is both a party to the dispute and, of necessity, the final arbiter, a condition of affairs which is not conducive to confidence in its impartiality. That the labour organisations on the Continent recognise this, is clearly shown by the memorandum presented by the International Federation of Transport Workers to the recent International Labour Conference at Geneva. The Federation claims the legal right for all railway men to form trade unions on the grounds of a clause in the "Labour Charter" of the Peace Treaty, which affirms the right of workmen to organise themselves "for all objects not contrary to the laws." The existence of railway trade unions is, however, not tolerated, in fact, even if by law, in several countries which are members of the League of Nations, such as, for example, Jugo-Slavia, Hungary, Roumania, Lithuania, and Italy. But the mere permission to form unions is by no means sufficient to satisfy the aspirations of the Federation. The freedom must be unrestricted, and must include the right to strike, presumably regardless of whether a strike is included amongst the actions "contrary to the laws" or not. It is, in fact, openly proclaimed that the right of combination without the right to strike is derisory. According to the Federation, the majority of States have found the means of restricting or abolishing altogether the right of railway employees to go on strike. In Holland, for example, although the right of combination and of holding meetings is guaranteed to all citizens by law, the law equally provides for the punishment by fine or imprisonment of any State employee "who refuses, after having received a legal order, to carry out the work for which he is engaged." A similar state of affairs prevails in Jugo-Slavia and also in Bulgaria, where incitation to strike is punishable by fine or by imprisonment up to a year. In Germany, since 1920, it has been asserted by successive Governments that the railway employees have no right to strike, and in 1922 the Minister of Transport compelled an organisation of railway officials to erase from their articles of association a clause including the strike as a weapon in their disputes. Esthonia is a country which maintains an old Russian law preventing railway strikes, although the constitution of the country contains an article to the effect that "the right of suspension of labour is legally admitted in Esthonia." The little Duchy of Luxembourg, democratic as it is, has also judged it necessary to restrict the right of railwaymen to strike, while Switzerland, a model of democratic Government and the Mecca of all sorts of international leagues to defend the rights of minorities, has safeguarded the rights of the majority of its own citizens by a statute forbidding "strikes and obstruction" on the part of the employees of the Federal railways. Besides these legal restrictions on the use of the strike as a weapon in various continental countries, the prevalence of compulsory military service gives the Governments a power of dealing with such strikes as may break out, which is almost irresistible. If the situation is sufficiently serious, a partial mobilisation order may be issued, calling the disaffected men to the Colours, and placing them under military discipline. So drastic a measure would never be sanctioned by a Parliament, unless it was necessary in the interests of public order or for the maintenance of the economic life of the country, but these are just the circumstances in which it is right that the will of the majority of the citizens should be able to make itself effectively felt. Of recent years, the French, Belgian, Bulgarian, Hungarian and Greek Governments have all had to have recourse to the powers of compulsion conferred on them by the military systems in order to assure the operation of their railway systems.

What the International Federation of Transport Workers claimed at the Geneva Conference was simple, but comprehensive. It demanded the right for railway workers in all countries to combine in defence of their interests, and, as a corollary, the right to strike without legal or other restriction. The Federation asserted that railway men would never misuse such rights, being fully conscious of their responsibilities towards the general population. The strike would never be resorted to except as a last resort, and when public opinion was favourable to the railway men's demands. The value of this profession of moderation is, however, nullified by the fact that there is no certain means of knowing what the public thinks on any subject. Moreover, if any fraction of public opinion makes itself heard, there is still the question whether the individuals concerned have any accurate knowledge of the case in dispute. The only point upon which the public would be unanimous and also competent to judge, would be whether it wanted the railway service to be maintained or not. Of its answer to such a question there could be no doubt. No railway strike can ever have public opinion behind it, however much the public may wish to see any given grievances rectified. It is, indeed, significant that no general strike, in which the interests of the public have been directly affected, has ever been successful. The community is stronger than any section of it, and soon learns to organise itself sufficiently to defeat an attempt of a minority to hold it to ransom. The experience of Stockholm, Winnipeg, and more recently of Great Britain, has demonstrated this. Any extensive railway strike therefore is a weapon which is likely to break in the hands of those who use it—a fact which ought by this time to be recognised by all responsible leaders of labour. Moreover, to demand, as the Federation does, the free and untrammelled right of the members of a trade union to subject their fellow-citizens to an economic blockade whenever it may please them to do so, comes awkwardly from a body which would be the first to demand that any international dispute should be settled by arbitration rather than by a trial of strength.

Centenary of the Shaw's Water Company's Works.

ON the 22nd inst. the Corporation of Greenock celebrated the centenary of the opening of the Shaw's Water Company's works for the supply of water to the town of Greenock and for operating a number of power plants. In a brochure which had been prepared to mark the occasion, it is pointed out that the first legislative provision regarding water for the town was made by an Act of Parliament passed in the year 1773, which was the earliest Police Act for the burgh. The undertaking was placed under the charge of a body of Trustees for "supplying the inhabitants with fresh and wholesome water, and for paving, cleansing, lighting and watching the streets and other public places." For these purposes the Trustees were empowered to lay a tax on the inhabitants "not exceeding 6d. per pound of the real rent of houses and other subjects possessed by them, and a rate upon shipping taking water." The population of the burgh was then about 10,000.

Under the Act two small reservoirs were constructed at the head of Lynedoch-street, and water was conveyed from them in wooden pipes to a cistern in the Well Park. It is interesting to note that the survey for these reservoirs was carried out by James Watt, who was a native of Greenock, and that one of the reservoirs—the Berry Yards Reservoir—is still in existence, being used for the supply of unfiltered water for industrial purposes. To increase the supply, the Trustees, in 1811, feud a piece of ground at Murdieston, where they constructed a reservoir known as the Town's Dam.

Prior to 1825, however, the town enjoyed a very insufficient supply of water, and, in dry seasons, much inconvenience was felt by the public, not only on account of a local want of water, but in consequence of being obliged to cart it from a distance for ordinary purposes. Some time previously, Sir Michael Shaw Stewart, Bart., who was the Superior of Greenock and of the greater portion of the lands in the neighbourhood, had employed engineers to investigate the possibilities of making the supply more satisfactory. In 1824 a Mr. Thom, of Rothesay, who was a water engineer of considerable repute, reported to him that it was possible to form a reservoir in the course of Shaws Water by the construction of an embankment at the lower end of the Shaws Meadow, and to bring the water to the town by means of an aqueduct. Part of the scheme was the formation of power stations in several places, by means of water-wheels, at which points it was expected that factories would spring up.

Sir Michael decided to act on the report, and, to carry it into effect, he formed a company under the name and style of the Shaws Water Joint Stock Company, which obtained an Act in 1825, entitled "An Act for Collecting the Shaw's Water and applying the same to the Driving Mills and Machinery near the Town of Greenock in the County of Renfrew, and for Supplying said Town and Harbour thereof with Water." The necessary works comprised the formation of what was originally termed the Great Reservoir, but is now known as Loch Thom, after its constructor, which contained 1780 million gallons, a compensation reservoir, which contained 90 million gallons, and a main aqueduct, known as the "Cut," which is 5¾ miles in length. A small reservoir, known as No. 3, was also constructed on the moor above the main aqueduct, and, at a later date, several additional small reservoirs were formed. Power was actually given to construct two aqueducts with falls descending through the town, but only one, known as the Eastern Line Lead, was constructed. The company, in course of time, entered into feu contracts with millowners, who erected mills and factories alongside the aqueduct, and to whom it furnished

water for driving machinery. The company charged a feu-duty for the land and a water rent in respect of the water supplied. The aqueduct was at a level of some 500ft. above the town, so that there was a considerable fall for the production of power. The opening of the works took place on April 16th, 1827, the sluices permitting the water to flow from the reservoir into the aqueduct being raised by the then Chief Magistrate, Mr. William Leitch, who immediately afterwards entered a boat and floated down the channel.

A full account of the proceedings appeared at the time in the *Greenock Advertiser*, and of it a long abstract is given in the brochure to which we alluded above. Part of the abstract is as follows:—"The spectacle of a vessel skirting the mountain's brow, and tracking the sinuosities of the Alpine chain at so great an elevation, seemed the realisation of a dream of the wildest fancy, and the course of the boat was followed by crowds of delighted spectators. It arrived at Everton, in the vicinity of the town, exactly at a quarter to three, where it was received with cheers and a salute of cannon. The water was then allowed to flow into the regulating basin for three-quarters of an hour. It is at this point that the stream takes its descending course and a sufficiency of water having been poured into the basin at half-past three, the sluice was opened by Sir Michael Shaw Stewart, sixth Baronet, and the torrent bounded down each successive fall and rolled along the alternate level with fearful activity. It was at this juncture that the scene became one of the most interesting and animated description. The spectators, who amounted to several thousands, but who had previously been scattered irregularly over a considerable extent of the aqueduct line, now became more condensed, and moved onwards, as if in procession, following the march of the stream. In the appearance of the aqueduct a complete change had now taken place. What, a few minutes before, was a dry unmeaning channel, exhibited now an impetuous torrent; by turns a cascade sending up clouds of spray and a swift-rolling current, seeking its unquiet course towards the Clyde, whose ample waters lay far beneath. Arriving at length at one of the lowest falls on which the new Flour Mills belonging to the Society of Bakers have been erected, the Shaws water no longer disported itself idly and in vain. The dizzying wheel was set in motion, with the fine machinery of the mills, and added new life to the scene. A discharge of cannon announced this event also. The mills and granary are on an extensive scale, and the former are driven by a water power equal to 28 horses. The machinery, which has been constructed by Mr. John Wood, Engineer, is remarkably fine, and by competent judges is pronounced inferior to nothing of the kind in Scotland. At half-past four the Shaws water, which for ages had discharged into the Clyde at Inverkip, now terminated its easterly course in the river above this town.

"In conclusion, we cannot help remarking as a most singular circumstance that the birthplace of Watt should have become the theatre for exhibiting the earliest practical demonstration, on a practical scale, of a great mechanical power, rivalling the utility of his own, and been the means of adding another name to the bright record of ingenious men, who have proved at once the benefactors of their country and of mankind."

The undertaking, the brochure continues, proved a complete success, and the demand for water grew so rapidly that the company in 1845 obtained another Act of Parliament to enable it "to increase the Supply of Water for driving Mills and Machinery near the Town of Greenock and for the Use of the Inhabitants of the said Town and Harbours thereof." Under the powers of that Act the company constructed the Kelly and Crawhin reservoirs, and the Kelly aqueduct, about 4¼ miles in length. It also constructed another aqueduct, known as the New Eastern Line of Lead, which branches off the original or Eastern Line of Lead at a point in the town situated about 180ft. above sea level.

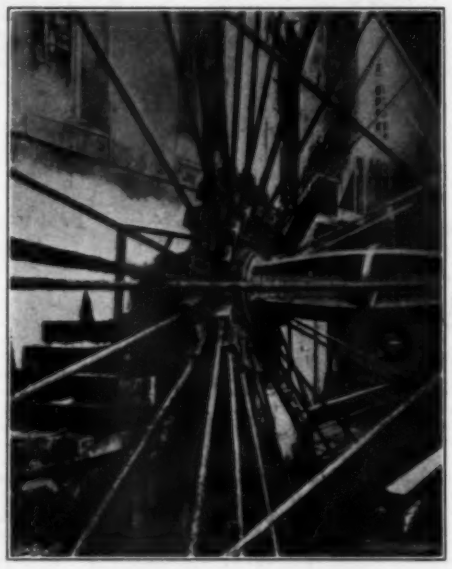
About the year 1838 the water supply provided by the Water Trustees of the town had become inadequate, and as a result the Trustees entered into an agreement with the Shaw's Water Company, whereby the latter undertook to run into the Town's reservoir at Murdieston a quantity of "pure and wholesome" water amounting to 21,000 cubic feet per day, as a consideration for which the Trustees agreed to abandon in favour of the company the right to supply the shipping, and also the legal power which, with trifling exceptions, they had not exercised, of supplying water by private pipes.

Going back to the year 1829, the brochure quotes the following passage on the filtration of the water, which was written in March of that year by Robert Thom to Sir Michael Shaw Stewart. The filters had been constructed at Greenock:—

"I cannot now enter into a particular or detailed account of these filters, but shall do so and forward it with a plan at my earliest convenience. In the meantime I may state that the water is made to pass through a body of very fine, clean, sharp sand, of about five feet deep; and that the water is, by a very simple contrivance, made to enter either at the top and percolate downwards, or at the bottom and percolate upwards, as we please; and when, in filtering, it percolates downwards, then, whenever the quantity of pure water falls short by the lodgment of sediment amongst the sand, the water is made to enter for a little at the bottom, and passing upwards with considerable force, carries the sediment out at and over the top into a waste drain made to receive it. In a few minutes the sediment is thus removed, and then the water being again made to enter at the top, the filter goes on as before, producing the full quantity of pure water."

With regard to this quotation, the brochure remarks that "it is interesting to note that this method of cleaning the filters by a reverse current of water is similar to that now adopted in the most modern installations of 'mechanical' or rapid filters."

With the continued growth of the town, the water supply for domestic purposes again became inadequate, and there were many questions in dispute between the company and the town. As far back as 1846 a motion was made in the Town Council and Police Trust for taking measures to acquire the company's works. At that time, however, the state of matters was not quite ripe for so important a transaction, and the matter was not gone into; but the subject did not fall out of the public mind. In 1863 it became necessary to obtain a new Police Bill, and it was resolved to set the water question at rest at the same time. In 1866 there was passed the Greenock and Shaw's Water Transfer Act, by which the town purchased the whole of the Shaw's Water Joint Stock Company's works for £170,000, and also undertook all the obligations imposed upon the company in terms of its Acts of Parliament and relative feu contracts. In the same year another Act, entitled the Greenock Water (Additional Works) Act, 1886, was passed, and under the powers contained in it, two other



HUB OF 70ft. WATER WHEEL

reservoirs, called the Gryfe reservoirs, were constructed by the town. At a later date it was also found necessary to raise the embankment of Loch Thom so as to increase the capacity of that reservoir from 1780 to 2500 million gallons. At the present time the Greenock water undertaking comprises nineteen reservoirs, having a total storage capacity of 4230 million gallons, and a catchment area extending to 10,000 acres.

Along the "Old Line" Aqueduct between Overton and the sea, there are, in all, nineteen falls, varying in height from 17ft. to 64ft. 4in. which produce collectively 1283 horse-power. The falls are feud to various bodies and firms, and are used for the following purposes:—(*a*) Electricity power stations (2), by the Greenock Corporation; (*b*) a distillery; (*c*) foundries (2); (*d*) chemical works (2); (*e*) a net factory; (*f*) a sugar refinery; (*g*) a cereals factory; (*h*) woollen mills (7); (*j*) a rope works; and (*k*) paper mills (2). Along the New Line, between the same points, there are seven falls, varying in height from 14ft. to 48ft., and capable of producing collectively 283 horse-power, which is employed in three foundries, three distilleries, and one sugar refinery.

The quantity of water allotted for the Eastern Branch or Division of Mill Leads is 1200 cubic feet per minute for twelve hours—with one exception, in which the time is thirteen and a-half hours—"every lawful or working day." To ensure that the correct amount should flow, nine self-regulating sluices were originally employed. In Weir's "History of Greenock," which was published in 1829, it is stated that "the body of the water is so kept in check, through the various self-acting sluices, that during the stormiest night and should 'rains fall as it were their last,' in silence and loneliness they would act on, with that safety and precision which gives security to the district where the various embankments have been made." At the present time, only two of the original nine sluices are in operation—one at the compensation reservoir, and the other at Overton Reservoir. The self-regulating sluices on the Main Aqueduct for the discharge of flood waters were superseded by syphon spillways during the past year. The system was, as has been said, originally designed to supply water-wheels; nowadays, however, turbines have been installed at most of the mills. The following interesting details are given in the brochure of a large water-wheel which, until a few years ago, was in existence at "Millstends" Nos. 8 and 9, and which was at one time described as "a most perfect specimen of its class." The wheel, it may be added, was constructed in 1841 by James Smith, of Deanston:—"The total height of the waterfalls is 64ft. 4in., and the energy available is 230 horse-power. The wheel, which weighed 117 tons, was 70ft. 2in. in diameter and 12ft. in width. The cast iron shrouding was 17in. deep, and there were 160 buckets made of sheet iron, each holding 100 gallons of water. The axle weighed 11 tons, and was fitted with two cast iron centres, 10ft. in diameter, each weighing 8½ tons. The wheel made one and one-third turns per minute, and the main shaft into the mill made 50 turns per minute. The water, which was conveyed in an iron trough to the wheel, was delivered about 6½ft. from the top, and the action of the sluice was regulated by an ingenious governor which was considered to be an excellent specimen of this indispensable adjunct of prime movers of all kinds." A view of this wheel taken before it was dismantled is reproduced in the accompanying engraving.

A few years ago an extension of the Greenock waterworks having become necessary, a Provisional Order was successfully promoted by the Corporation for the acquisition of the water rights of the mill-owners situated on the New Eastern Line of Lead. As a result, a supply of water amounting to 4½ million gallons per day was obtained for the town at a cost of £102,000. Agreements were entered into with several of these millowners, whereby the Corporation may send down the water supply formerly allotted to this Line of Lead whenever it is in a position to do so, and in return receive payment for the water. By this arrangement, the use of the water for power purposes is postponed until the public health requirements of the burgh are met.

The brochure ends with the following comments:—"The importance of utilising to its fullest extent the available water power of the country is becoming more apparent day by day, and great credit is due to the pioneers, Sir Michael Shaw Stewart, Baronet, and the other promoters of the Shaw's Water Company, who, in an age newly awakened by Watt to the possibilities of a powerful and economical steam engine, dared to launch, in confident rivalry, the great water power scheme which Thom's clear genius had outlined to them. The advent of the Shaw's Water Power Scheme undoubtedly opened up great possibilities to the then small town, and the fact that the scheme has stood the test of 100 years' continuous working shows that it was no idle dream on the part of the engineer."

BOOKS RECEIVED.

Large Uses of Steel in Small Ways. London: The Penton Publishing Company, Ltd., Caxton House, S.W. 1. Price 5s. net.

An Introduction to Building Science. By F. L. Brady. London: Edward Arnold and Co., 41, Maddox-street, W. 1. Price 7s. 6d. net.

Regulations for the Electrical Equipment of Buildings. Ninth edition. London: E. and F. N. Spon, Ltd., 57, Haymarket, S.W. 1. Price 1s. net.

Modern Steelwork. Edited by E. Fiander Etchells, A.R.I.B.A., &c. London: Nash and Alexander, Ltd., 103, Kingsway, W.C. 2. Price 5s. net.

Advertising, Printing and Art in Commerce. By J. F. Preston and E. Arch. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 16s. net.

The Engineering Index, 1926. New York: The American Society of Mechanical Engineers, 29, West 39th-street, U.S.A. Price $7·00 to non-members.

Anton Flettner: The Story of the Rotor: from the German "Mein Weg zum Rotor." London: Crosby Lockwood and Son, 7, Stationers' Hall-court, E.C. 4. Price 9s. net.

Meteorological Report for the Year 1921. Physical Department of the Ministry of Public Works, Egypt. Cairo: Government Publications Office, Dawawin P.O. Price P.T. 40.

Wellington Harbour Board: Statement of Accounts, with Annual Reports and other Statistics for the Period Ended September 30th, 1926. Wellington (N.Z.): H. L. Young, Ltd. 1927.

The Measurement of Mean Spherical Candle-power. Illumination Research Paper No. 5. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 1s. net.

Annali dei Lavori Pubblici (già Giornale del Genio Civile): Ministero dei Lavori Pubblici, Consiglio Superiore. Anno LXV. No. 3. Marzo, 1927. Rome: Provveditorato Generale dello Stato Libreria.

The Theory and Practice of Rolling Steel. By Wilhelm Tafel, translated by R. Rimbach. London: The Penton Publishing Company, Ltd., Caxton House, S.W. 1. Price 30s. net.

Bauxite: A Treatise Discussing the Origin, Constitution, Known Occurrences and Commercial Uses of Bauxite. By C. S. Fox. D.Sc., &c. London: Crosby Lockwood and Son, 7, Stationers' Hall-court, Ludgate-hill, E.C. 4. Price 30s. net.

EXPERIMENTAL CRITICAL PRESSURE BOILER

THE SIEMENS-SCHUCKERTWERKE, BERLIN, ENGINEERS

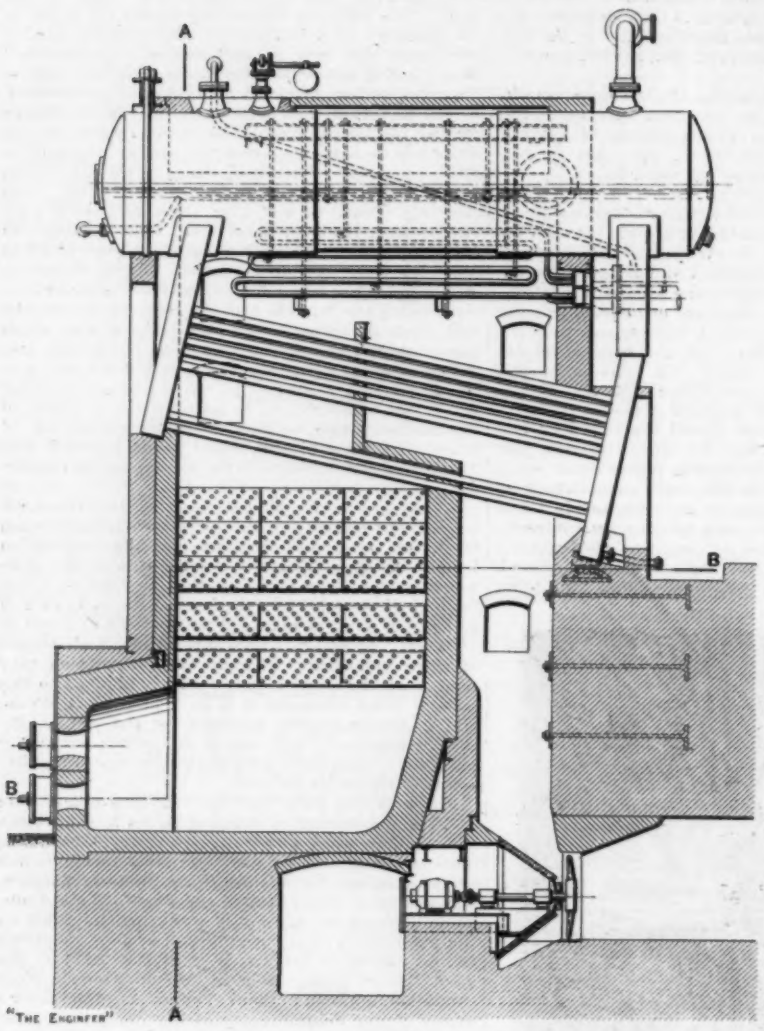


FIG. 1

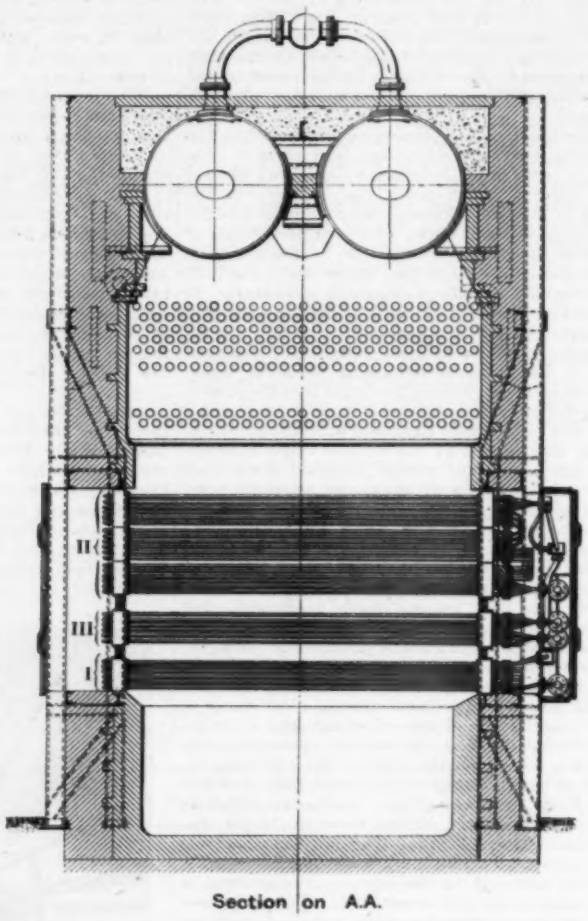


FIG. 2

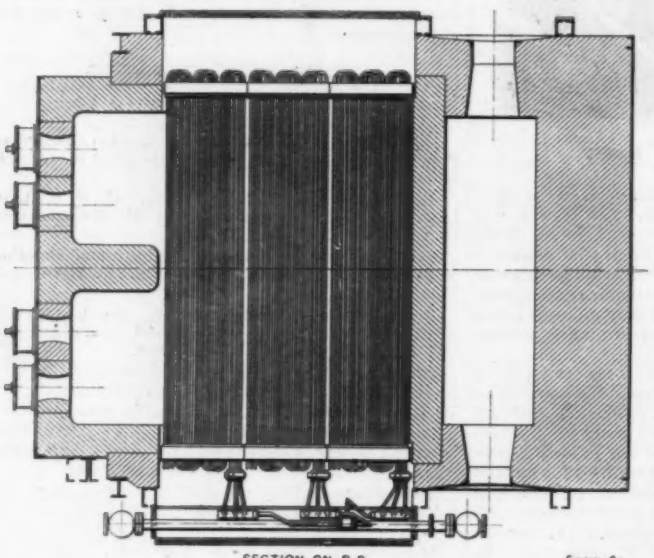


FIG. 3

The Siemens-Benson Critical Pressure Boiler.

IF the water in a boiler is heated to about 705 deg. Fah., the steam pressure will be 3158 lb. per square inch. Under these conditions, the density of the water will be so much reduced by the high temperature, and that of the steam so much increased by the high pressure that the two densities will have become equal. Since by the nature of the case the temperatures and pressures are also equal, there will be no physical difference between the water and the steam. The boiler indeed will be filled with a substance which may be called either steam or water, but is more properly regarded as steam, because, so long as the temperature is not reduced, no liquid can be present. By working a boiler, therefore, at any temperature and pressure above the critical, water is changed into steam without any ebullition on the heating surfaces and without the necessity for any surface of disengagement. It follows therefore that such a boiler could be constructed without a drum and might consist merely of a length of heated tube, the water forced in at one end coming out as steam at the other.

Quite apart from its very high pressure, steam raised under such conditions could not be used efficiently, for with even the least adiabatic expansion about half of it would at once condense into water. Since its temperature, moreover, is too high to permit of this undesirable characteristic being sensibly modified by such superheat as constructional materials can stand, the only practicable way to make use of this principle of generation is to reduce the pressure to a reasonable figure by throttling, and then to dry and superheat the lower pressure steam so produced. It seems clear from an article which appeared in the *Journal* of the Franklin Institute in 1827 that the first man to generate steam above the critical pressure and to reduce it to a workable condition by throttling and superheating was Jacob Perkins more than a hundred years ago. Like so many other inventors Perkins was before his time, and the modern developments of the process must be credited to Mark Benson, whose first boiler was put down in the works of the English Electric Company, Ltd., at Rugby, in 1922. This boiler generated 9900 lb. of steam per hour at 3250 lb. per square inch, the pressure being reduced by throttling to 1500 lb. per square inch and superheated at that temperature to about 800 deg. Fah. The steam at this latter pressure and temperature was used to drive a turbine built by the English Electric Company, which developed 500 B.H.P. when exhausting against a back pressure of 200 lb. per square inch. The success of the plant was such that the Benson patents were acquired by Messrs. Siemens-Schuckertwerke, of Siemenstadt, Berlin, who at once put down a plant of their own in order to investigate thoroughly the possibilities of the system. This plant was ready by the end of 1924 and has been operated altogether more than 2000 hours, for testing purposes.

For their experimental installation, Messrs. Siemens-Schuckertwerke decided to construct a boiler capable of a maximum output of 22,000 lb. of steam per hour at 1420 lb. pressure and 756 deg. Fah. at the stop valve. Instead of building it as an entirely separate unit, it was considered preferable to combine it with an existing boiler, which would act as a feed heater, this plan not only economising space, but serving to determine the practicability of the development of low-pressure boiler plants generally along similar lines. The arrangement actually adopted is illustrated herewith. A Borsig horizontal tube boiler constructed in 1903, having a heating surface of 3283 square feet and built for a working pressure of 185 lb. per square inch, was raised several feet above its original level, and in the extra space thus made available beneath the tubes the high-pressure generating elements were placed. The boiler was fitted for firing with oil burners for convenience of testing and manipulation.

The Benson elements consist of groups of horizontal tubes set transversely across the combustion space, the lower tubes forming a roof to the furnace. The tubes are of ordinary steel, 20 mm. (0·787in.) internal diameter, and 32 mm. (1·259in.) external diameter. They are arranged in three decks vertically, marked I., II., and III., on Fig. 2. The feed water is heated to 180 deg. Cent. in the low-pressure boiler, and is therefore under a pressure of 130 lb. per square inch. At this temperature and pressure it enters the high-pressure feed pump, which delivers it into the lowest tube deck I. In this deck, which constitutes one-fifth of the high-pressure heating surface, the water is raised to a temperature above the critical, and therefore passes as slightly superheated steam at 3200 lb. per square inch through the end connections to the deck of tubes marked II. in Fig. 2. This deck of tubes constitutes three-fifths of the high-pressure surface and serves to superheat the steam to 752 deg. Fah. At this temperature, and still at the pressure of 3200 lb. per square inch, it is taken to a throttle valve by which its pressure is reduced to about 1490 lb. per square inch. At this lower pressure it is delivered to deck No. III., in which it is resuperheated to about 770 deg. Fah.

The total heating surface of decks I., II., and III., which together constitute the high-pressure part of the boiler, amounts to 2325 square feet. The lowest

deck consists of three elements, each of which is made up of three separate tubes doubled backwards and forwards so as to give thirty-six passes through the furnace. The three tubes of each element are connected in series. They are not fixed rigidly to any part of the boiler framing, so as to have freedom to expand, and they are supported midway across the furnace by steady-plates of cast iron, which maintain their spacing. The three elements are connected in parallel. All connections are out of the furnace space at one side of the boiler, where they can be kept easily under observation. Tube deck II. consists of nine elements in all, each element being similar to those just described, but having its three tubes connected in parallel. The elements themselves are connected vertically in series and horizontally in parallel. Tube deck III., which acts as a superheater for steam at the reduced pressure, has both tubes and elements in parallel, so that the steam has altogether nine alternative paths through this deck. The headers connecting the sections are pipes about 2·75in. diameter, into which branches of the same diameter as the tubes are screwed and welded. The connections between these branches and the individual pipes are made with oval flanges screwed on. The flanges have circular central bosses of small diameter on their adjacent faces, so that the joint itself, which is made by means of a metal ring squeezed between the countersunk pipe ends, can be seen. These joints have been entirely satisfactory.

It is essential to the principle of the Benson boiler that, whatever the load, the pressure in the tube decks I. and II. shall be maintained at at least 3158 lb. per square inch. To this end the furnace and the feed water must be simultaneously controlled, either by the fireman or by some automatic apparatus. The pressure is regulated in the Siemens-Benson boiler either by a hand-operated angle valve which controls the outlet of the tube deck II., or by an automatic regulator which serves the same purpose. The casings of these valves are of cast steel and the valves themselves and their seatings of stainless steel. There are also safety valves fitted to the boiler, which limit the pressure in tube decks I. and II. to about 3300 lb. per square inch, and in deck III. to about 1500 lb. per square inch, and thus safeguard the tube systems and the feed pump.

The feed pump used for the high-pressure part of the boiler is of the three-plunger vertical type similar

TABLE.—*Tests of the Siemens-Benson Boiler.*

Steam generated, lb./hr.	7,110	10,530	13,410	16,920
Feed water temperature, deg. Fah.	68	71·6	73·4	71·6
High-pressure feed pump suction, lb./in.²	60	111	138	138
Ditto, deg. Fah.	282	329	349	349
Feed water entering Benson section, lb./in.²	3,280	3,260	3,260	3,280
Ditto, deg. Fah.	284	331	352	352
Gas temperature above upper deck, deg. Fah.	523	556	570	564
Gas temperature above intermediate deck, deg. Fah.	617	664	669	662
Gas temperature above lower deck, deg. Fah.	702	700	694	696
High-pressure side of reducing valve, lb./in.²	3,220	3,150	3,020	2,970
Ditto, deg. Fah.	738	738	734	718
Low-pressure side of reducing valve, lb./in.²	1,450	1,450	1,475	1,510
Ditto, deg. Fah.	592	590	592	588
Outlet of superheater, lb./in.²	1,420	1,410	1,420	1,410
Ditto, deg. Fah.	750	766	766	750
Power for high-pressure feed pump, kW	31·7	46·4	60·2	79·6
Consumption of fuel oil,* lb./hr.	1,107	1,492	1,760	2,155
Number of oil burners	4	4	5	6
Pressure of fuel oil, lb./in.²	78	128	107	126
Exit flue gas temperature, deg. Fah.	374	415	482	532
Percentage of CO_2	11	11·5	12	12·2

* N.B.—Calorific value of fuel oil = 17,910 B.Th.U. per lb.

to that used for hydraulic power work. Water from the low-pressure boiler flows to it under a pressure of 140 lb. to 170 lb. per square inch, and at a temperature ranging between 360 deg. and 375 deg. Fah. This water is raised by the pump to a pressure of 3340 lb., and delivered to the feed line. The pump has a capacity of 22,000 lb. of water per hour, and requires 85 kW to drive it at full load. It is driven by a variable speed direct-current motor connected by a belt.

A large number of tests have been carried out on the boiler during the last eighteen months. Its small water content appears to present no serious operating difficulties, but, on the other hand, enables the boiler to respond with great rapidity to different demands for steam. Full steam pressure can be raised in twenty or twenty-five minutes, even with moderate firing, and the time could be brought down to a quarter of an hour or so in case of necessity. The small water contents of the boiler, moreover, make it essentially a safety boiler in spite of its high pressure. On one occasion a tube burst owing to the use of dirty feed water, and a consequent scaling up and over heating of the tube. There was no particular commotion, the rush of steam from the burst tube put out the oil burners, and mostly escaped up the chimney. Beyond a little bending of the pipe near the point of rupture, there was no destruction of the boiler. The element affected was replaced by another, and the boiler was in service again the following day. The damaged part of the burst tube, a piece about a yard long, was cut out and another piece welded in with thermit, the element then being ready for further service.

In a recent issue of the *Zeitschrift des Vereines Deutscher Ingenieure* some figures concerning the performance of the Siemens-Benson boiler were given by Dipl-Ing. W. Abendroth, to whose article we are indebted for the preceding table and for certain other data relating to the plant.

The figures given in the table represent data collected during an eight-hour test. Temperature measurements are believed to be correct within 2 per cent. and pressures within 1 per cent. The feed water was measured into the low-pressure boiler and also into the high-pressure boiler, though only the figures concerning the latter are tabulated. Temperature measurements were made by means of copper-constantan thermo-couples placed in different parts of the boiler and connected to a pyrometer. The first two columns of the table do not lend themselves to a calculation of the efficiency of the high-pressure boiler, because the conditions in the low-pressure boiler, with its large water contents, were not steady. From the other two columns, efficiencies of 72 and 74 per cent. can be respectively calculated, but these figures must be viewed in the light of the combination of the high-pressure part of the plant with an existing low-pressure boiler not specially designed for such service.

The plant is used to drive a nine-stage impulse turbine designed to take steam at 1420 lb. pressure and 752 deg. Fah., and to exhaust against a back pressure of 185 lb. The turbine runs at 10,000 r.p.m., and drives a 1000-kW direct-current dynamo at 3000 revolutions through gearing. As regards the results obtained generally with the Siemens-Benson boiler, it is sufficient evidence of the satisfaction which the plant has given to say that a new boiler is now under construction, designed for the delivery of 55,000 lb. to 66,000 lb. of steam per hour to a turbine, at a pressure of 2560 lb. per square inch and a temperature of 788 deg. Fah.

Theory and Practice.

THE following passage occurred in the presidential address delivered by Dr. Herbert Lapworth before the Institution of Water Engineers on June 8th last:—

"To define what is scientific method is not easy, and it is instinctive and inherent in many who have never actually received a scientific training. Broadly, in relation to any investigation or problem, I should say that, in opposition to 'rule of thumb,' which is partly instinct and partly derived from experience, it is insisted, as a safeguard or tempering to pure instinct and one's usually limited experience, firstly, that as far as possible all data relating to similar previous investigations or problems should be collected and examined; and secondly, that the solution or answer should, in the light of this research, and one's own experience, be estimated as closely as possible beforehand by consideration, calculation, or deduction. At opposite poles the 'rule-of-thumb' man says, 'Let us try this; I feel this is right;' the academic man says, 'I have worked it out, and this ought to be the solution.' At such extremes both may frequently be wide of the truth.

"In the great bulk of our engineering practice, of course, neither pure science nor the practical sense alone can serve the best results. Kipling has summarised the essential great truth in the words quoted at the beginning of this address: 'By reason and experiment. The one is useless without the other,' and this applies to the whole realm of science and engineering. At the one extremity, it is true there are many problems which can only be solved by what is termed 'judgment,' at the other are questions to which scientific calculation alone can find an answer. But in the centre lies a considerable proportion of our difficulties, in which theory and practice, or science and experience, play equal parts.

"The lacunæ in the purely practical and purely academic are fairly obvious. The solution of engineering problems often involves so many factors, some unknown and some incapable of being expressed in measure, that a purely theoretical or mathematical treatment is impossible, unless so many assumptions are made that one might be justified in assuming the answer at the very outset.

"The graduate fresh from college is inclined to think that most engineering problems can be solved by mathematical deductions, assuming that with one or two factors known other factors may be ignored; and further, to expect a degree of accuracy which is hopelessly incapable of being realised in practice. This, I believe, is partly due to the fact that during an engineering course it is almost impossible for professors constantly to demonstrate all the exceptions and factors which modify the application of the general scientific principles they teach. A certain rigid dogmatism must be maintained, otherwise great confusion is apt to rise in the mind of the student. Nevertheless this rigidity tends to encourage distorted views, which may not be rectified for years, and never entirely in exceptional cases. It is probable that a more balanced perspective would be attained if one's theoretical studies were entered after some years of practical experience; but there are grave difficulties in such a procedure, and it is doubtful if it is practicable.

"At the other extreme the assumption by the purely practical man that engineering problems can invariably be solved by common sense is almost equally dangerous. Doubtless the practical man possesses an intuitive sense of the many unknown factors involved in one's work; but in engineering to-day common sense *per se* is not quite enough; it cannot answer many questions, and may sometimes fail woefully in the analysis of data and its application to fresh lines of research. I am inclined to think, while admiring the so-called 'practical' man in many ways, that he is rather apt to judge solely by his own and naturally limited experience, and to believe there is only one way of doing a job, whereas a wider sense teaches that there may often be several ways, more or less equally good, of attaining the same end.

"Probably the most striking example of balanced theory and practice is to be found in the late Thomas Hawksley. Thoroughly practical in every sense, he constructed more waterworks than any follower, and applied to his work the scientific method in almost as perfect a way as it seems possible to achieve. Throughout the whole of his exceptionally arduous life he collected and analysed a mass of data and established a large number of basic principles, rules and formulæ, many of which to this day are largely followed in waterworks practice. His technical knowledge and scientific attainments appear to have been largely, if not entirely, self-acquired, and one cannot fail to admire profoundly the skill and methods of this undoubted genius.

"It has been said, however, that not the least benefit of science is the scepticism it encourages and the reluctance to taking customs and rules for granted; or rather, perhaps, that before acceptance and action we should learn and examine what has been done by others. This is surely a healthy and sound attitude of mind in our own work, but there must naturally be a limit to this in practice. We have to get on, and are compelled to accept more than we can fully explore, for an ultra-critical sense is the negation of action, either in engineering or any other sphere of activity.

"My chief sympathy, however, with the sceptical attitude is more in relation to the many rules and formulæ we are apt to accept as the last rigid word. Many of these undoubtedly have served and still serve a useful purpose; they are time-savers and usually help us to avoid serious errors. But if we could examine their sources and origins we should often be surprised to find that they are based on flimsy, inadequate and unreliable data, and at best extend over a much narrower range than they are supposed to do. I am convinced that, while familiarising oneself with the work of others, it is wise to attempt as far as possible to get back to first principles unhampered by rigid rules, though it is not always easy in actual practice.

"Within our own time great advances in waterworks engineering from the direct application of science have been secured. In general, designs have become more refined and many of our old rules and methods considerably modified. Research into the chemistry and biology of filtration and the treatment of water has effected material reduction in capital cost and greatly increased freedom and safety in the use of doubtful waters. This will probably result in a wider resort to river waters in the not too remote future, when our upland and underground sources of pure water have become largely exhausted. Investigations in pipe linings, pipe materials, and the corrosion of pipes are still actively proceeding, for these problems are much in a state of flux and revolutionary changes may be expected at any moment.

"To mechanical science we are indebted for continuous research into the use of oil, gases, and electricity as prime movers, often replacing steam, with materially reduced capital cost. The rapidly extending use also of high-lift centrifugal pumps of increasing efficiency is to be specially noted.

"Finally, to mathematical and physical science we owe much in the use of reinforced concrete and in improved precision in hydraulic calculations and methods of measuring and metering water. Through mathematics also we are in general attaining greater economy in the design of works, and attempting to confine within more reasonable limits the extravagant 'factors of safety' of the past."

National Federation of Iron and Steel Manufacturers.

THE dinner held by the National Federation of Iron and Steel Manufacturers at the Connaught Rooms on Thursday, June 16th, was the most largely attended of any of the Federation's banquets. Whether that was because the Chancellor of the Exchequer was the principal speaker or whether it indicates the growing influence of the Federation, we cannot say. Mr. H. C. Bond occupied the chair, and in proposing the toast of "His Majesty's Government," he alluded to the fact that the ever-rising walls of tariffs made it increasingly difficult for British iron and steel manufacturers to find adequate markets for their products in foreign countries. They had therefore to look to the British Empire to absorb their products. "It must not be forgotten," he said, "that great as is the financial and commercial influence of this country in the world of international commerce, we are essentially an industrial nation. Out of our population, 14 millions are engaged in industry, and I venture to suggest, not only to H.M. Government, but to the people of this country generally, that if we are to maintain our position in the world, and if we are to provide the standard of living for our people which we now accept as a minimum, we must devote more attention to the prosperity of industry and the conditions which govern prosperity than we have done in the post-war years. We cannot keep any large proportion of these 14 millions of people employed upon the production of luxuries or by catering for amusement or by buying and selling the goods of other countries, or by financing the trade of other countries—and even their industries—in competition with our own." Touching upon taxation, he referred particularly to the ever-increasing burden of local taxation and expenditure. The average cost of local rates and taxes per ton of steel plates throughout the United Kingdom was 1s. 7d. in 1913 and was now no less than 4s. 7d. Furthermore, social services, imposed upon industry by statute, cost now 4s. 3d. per ton, as compared with 1s. 7d. in 1913. In conclusion, he observed that Great Britain had to compete with foreign nations, which worked longer hours for lower wages, and he desired to impress upon the Government that, in his opinion, the question of working-hours was even of greater importance than the question of wages.

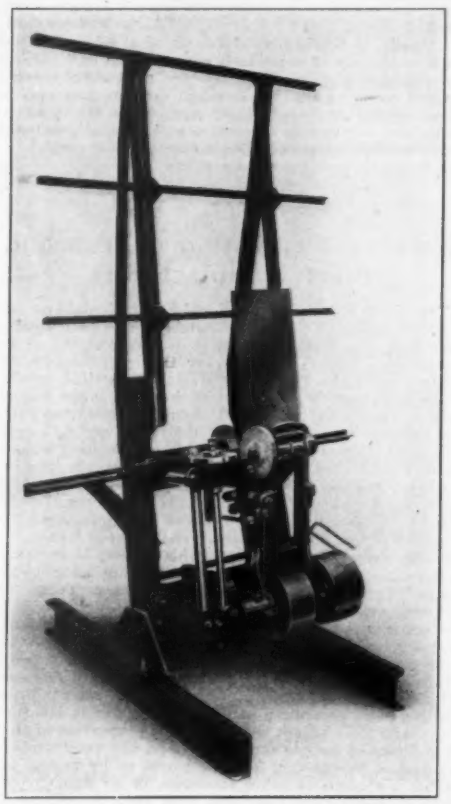
Mr. Churchill, in acknowledging the toast, said that this country was actually more prosperous than it had been; but it was not enough to make actual progress, a

proportionate progress must be made if Great Britain was to maintain its position in the world and play its part as the centre of a world-wide empire. He assured the Federation that the Government would do its best to lighten the burdens under which it laboured. Though well aware of the extremely difficult conditions which faced the iron and steel trades, he looked forward beyond the immediate troubles, and proclaimed himself an optimist.

The health of "The Iron and Steel Industries" was proposed by the Right Hon. Sir Philip Cunliffe-Lister, in a speech which was principally devoted to an advocacy of amalgamation and federation. The response was made by Mr. Benjamin Talbot, who acknowledged the charge which was sometimes made that Great Britain was not keeping pace in improvements with foreign nations. That was not because we lacked the technical knowledge or the practical experience and skill in managers and men, neither did it lie in the absence of the necessary raw materials or unfavourable geographical position. The reason was to be found in the unfair and unequal trading conditions that had been imposed upon British steel makers for many years, which did not permit them to make the same profits as their foreign competitors. He proceeded then to give figures from the United States Steel Corporation to confirm this view. If British steel works could make improvements out of profits, they would be on a par with any plant in the world. Finally he touched upon the question of protection. "If," he said, "the importation of steel from protected countries is encouraged, and continues to come in large quantities, restriction of our output is bound to follow, and we shall not keep pace with our foreign competitors in improvements or efficiency. It may be that the voters of the country are indifferent as to whether we progress and keep our position internationally or not. They may say that unless we can manufacture and compete with foreign steel with its fiscal preferences, made from raw materials and produced under a lower standard of life than ours—both in wages and hours of work—we must accept the consequences. If this is so, then, I believe, a few more years of large imports will bring about a continued decline until we reach a stage where the country is mainly dependent on foreign sources of supply for shipbuilding, engineering and working-up industries."

A New Sheet Edge Grinding Machine.

In order to produce a neat seam when welding metal sheets by modern methods, it is necessary to ensure that the edges of the sheets are metalically clean before the actual welding operation is begun. Such a precaution is particularly necessary when sheets of poor quality, such as scaly sheets, or various kinds of galvanised work have to be dealt with. In order to clean sheets, both pickling



THE SOAG SHEET EDGE GRINDER

and sand-blasting are sometimes resorted to. One disadvantage of pickling, however, is the possibility of subsequent rusting, while sand-blasting is often a cumbersome process with sheet metal work. A good way of preparing the sheets for welding is to grind and slightly bevel both edges, which produces a clean metal face ready for jointing.

With the object of rapidly carrying out such a grinding operation, Soag Machine Tools, Ltd., of 45, Horseferry-road, Westminster, S.W. 1, has recently placed a new machine on the market. The Soag G.I. sheet grinder, which is illustrated in the accompanying engraving, will be seen to be a machine of simple construction. The main framework is a steel structure, to which is attached the driving and grinding mechanism. There is an under shaft furnished with fast and loose pulleys, which carries the driving pulley for the two grinding spindles. The grinding wheels are mounted on swinging frames, which are pivoted on the under shaft and carried on bushed bearings. The two spindles run in roller bearings and revolve at 3000 r.p.m. They are driven by a single belt, which passes over a jockey pulley. The distance between the grinding wheels is adjusted by means of set screws and springs, and while the wheels being suspended in inverted pendulum fashion are free to give sideways. The sheets to be ground are passed through the machine from left to right, and are fed between the grinding wheels by means of friction guide wheels, which are driven by two vertical shafts worked by gearing from the end of the main driving shaft. The distance between the guide wheels can also be varied as required to accommodate sheets ranging in thickness from No. 22 gauge up to ¼in. The feed speed is about 12ft. per minute, and the width of the ground edge formed by the grinding wheels is about ⅛in. A vertically arranged angle frame is supplied for use with large sheets. The makers claim that by using such a machine a more sightly weld is produced and less current is required when using electrical welding methods.

Balancing Gear for a Four-cylinder 250 B.H.P. Oil Engine.

WHEN describing the auxiliary machinery of the newly reconditioned and re-engined Canadian-Pacific liner Empress of Australia in our issue of last week, we referred briefly to the two 165-kW oil engine driven generating sets, and the special balancing fitted to them. We are now able, by the courtesy of W. H. Allen, Sons and Co., Ltd.,

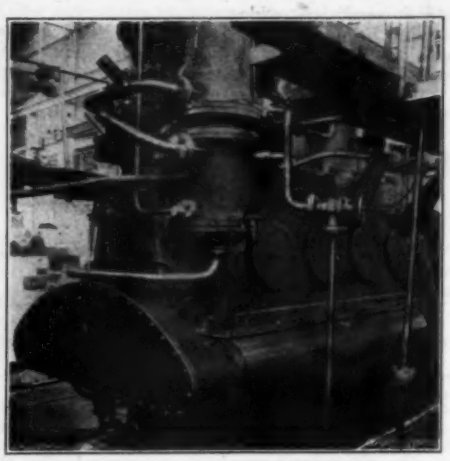


FIG. 1—END VIEW OF ENGINE

to give some further particulars of the type of balancing gear employed.

Each of the two units comprises a four-cylinder Allen-B & W type oil engine, having a cylinder bore of 325 mm. and a stroke of 400 mm., and designed to develop 250 B.H.P. when running at a normal speed of 300 r.p.m. The engines are coupled to 165 kW. 110-volt generators, which are mounted on a substantial dynamo bed-plate,

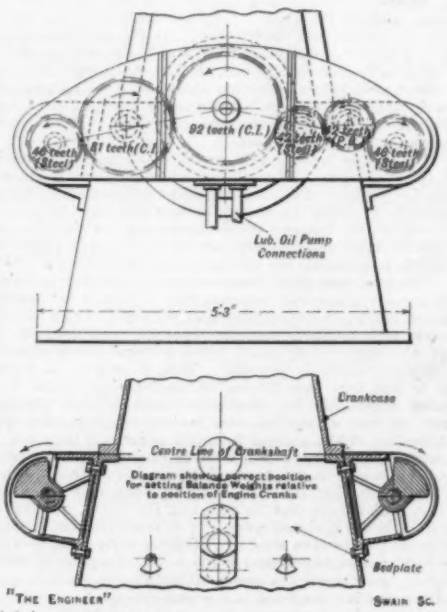


FIG. 2—ARRANGEMENT OF BALANCING GEAR

bolted to the engine bed-plate, which carries an intermediate bearing between the fly-wheel of the engine and the generator armature as well as the outer bearing for the armature spindle. The design of the unit was such as was shown by the makers' careful records not to possess unbalanced forces which would synchronise with either the natural period of vibration of the ship or that of the propelling machinery in such a way as to give rise to vibration. With a four-cylinder unit, however, which was essential to meet the space and output conditions, the out-of-balance forces were admittedly greater than those of a six-cylinder unit. The owners of the vessel were specially desirous that every precaution should be taken to avoid vibration, and for this reason they were agreeable that a suitably designed balancing gear should be fitted to the engine at an extra cost. The design adopted was first proposed, we understand, by Mr. James Thomson, of the technical department of the Fairfield Shipbuilding and Engineering Company, Ltd., and it was then adopted, worked out and applied to the engines in question by the designing staff of W. H. Allen, Sons and Co., Ltd., at Bedford. From the illustrations, Figs. 1 and 2, it will be seen that the gear consists essentially of two gear-driven shafts, one on either side of the engine bed-plate, to which the sector-shaped balance weights are keyed. Fig. 1 is a general view of the engine taken from the compressor end, from which the arrangement of the end gear casing and one of the side balance weight boxes can be seen. The upper view of Fig. 2 gives details of the gear drive. A cast iron spur wheel, with ninety-two teeth, is mounted on a spindle in line with the crank shaft centre, and is carried on bushed bearings formed in the gear case and its cover. This spindle is driven from an extension of the crank pin of the air compressor, which passes through a bushed hole in the solid oil pump gear wheel, mounted on the end of the driven spindle in the compressor crank case. On the left-hand side of the engine, looking from the end, there is an eighty-one-toothed cast iron intermediate wheel, which drives the forty-six-tooth steel wheel on the balancing shaft in an anti-clockwise direction. On the right-hand side two intermediate wheels, each having forty-two teeth, one of steel, and the other of phosphor bronze, are interposed, and they drive a similar steel wheel on the other balancing shaft which runs, however, in a clockwise direction.

The gear wheel and the bearings of the two balance-weight shafts are lubricated by a small oil pump of the gear type, which is neatly housed in the centre of the gear case near the bottom. The lubricating oil connections are shown in the upper view of Fig. 2. In the lower view a diagram showing the correct position for setting the balance-weights relative to the position of the engine cranks is given. This view also show the substantial balance-weight boxes which are rigidly secured to the machined sides of the engine bed-plate by a series of closely spaced fitting bolts. As well as the outward turning segmental balance-weights, which occupy a position between the centres of No. 2 and No. 3 cylinders, there are concentric masses fitted on the shafts between cylinders No. 1 and No. 2, which increase the inertia of the balancing system.

As shown by our illustrations, the gear wheels are easily made accessible by removing the cover of the gear case, while the revolving masses, the balance-weights and their bearings are conveniently enclosed by a light casing of planished steel.

The engines, which we examined while in operation aboard ship, ran very quietly, and the balancing gear appeared to fulfil admirably the purpose for which it was designed.

TELEGRAPH AND TELEPHONE WIRES.

Two specifications just issued by the B.E.S.A. are revisions of the 1923 editions, and are issued in two volumes, the first volume comprising specifications Nos. 174–181, and dealing with non-ferrous materials for overhead line wires, the second volume comprising Nos. 182–184, and dealing with galvanised iron and steel wire for the same purpose. The chief features in which these specifications differ from the 1923 editions are as follows:—(*a*) Specifications for cadmium-copper wire, tapes, binders and jointing sleeves have been included in specifications Nos. 175, 178 and 181, the only material recognised in the corresponding old specifications being bronze.

(*b*) A new class of material has been introduced into specifications 182–184, this being designated "high-purity iron." The composition of this material is fully specified, the high-purity iron being given as an alternative to the ordinary low-carbon steel, which, of course, is still retained.

(*c*) As the result of experience in working to the original specifications for galvanised line wire, it was found that the data given in the tables were in certain cases inconsistent as between the diameter and weight per mile of the wire. The tables have been fully revised, and are now perfectly consistent amongst themselves.

(*d*) Certain amendments have been made to the galvanising tests described in specifications 182–184.

Copies of these specifications may be obtained from the publications department, British Engineering Standards Association, 28, Victoria-street, S.W. 1, price 2s. per volume, or 2s. 2d. post free.

PORT IMPROVEMENTS IN COLOMBIA.

IT is reported from Bogotá that it has been decided to begin the improvement works contemplated at the ports of La Dorada, Calamar, and Barranquilla, in Colombia. The river port of La Dorada is on the Magdalena, 768 kiloms.—477 miles—above Calamar, and 874 kiloms.—543 miles—from the port of Barranquilla, and is the terminus of the Dorada Railway, which runs to Ambalema, 113 kiloms.—70 miles—away, passing round the rapids of the Magdalena. The port of Calamar, in the Department of Bolivar, is situated on the west bank of the same river, and forms the terminus of the Cartagena Railway. Cartagena, connected by canal with Calamar, 105 kiloms. —65 miles—away, is the capital of the Department of Bolivar. It is 1150 kiloms.—714 miles—from the Federal capital Bogotá, and is the best port on the north coast of South America. Formed by an indentation of the coast line, and covering an area of about 63·5 square miles, it is shut in by two long islands lying parallel with the

mainland, and thus affords deep and secure anchorage and ample facilities for loading and unloading large vessels. Notwithstanding the importance of the port, however, there are no modern quays, large vessels being unable to approach within a mile of the landing stage. The railway pier, on the mainland opposite, has in recent years been lengthened, permitting the mooring of vessels alongside.

The city of Cartagena is separated from the mainland on the east by a shallow lagoon-like extension of the bay, bridged by the causeway passing through the extra-mural suburb of Xiximani, on another island. It is intended to increase the wharfage space for vessels, erect a number of warehouses, and generally to improve the railway approaches.

At the port of Barranquilla, the principal commercial centre of the Republic, 1200 kiloms.—745 miles—from Bogotá, and which handles about 60 per cent. of the entire trade of the country, development work has already been commenced. This includes the continuation of the Bocas de Ceniza scheme, having for its object the removal of the bar at the mouth of the Magdalena River at a point seven miles above its mouth. Important dredging operations on the canal known as the Dique, connecting the Magdalena River, at Calamar, with Cartagena, are also in hand. When these port improvements have been completed much of the traffic hitherto carried by the Barranquilla Railway and Pier Company will be diverted.

A Joint Meeting of Institutions of Engineers and Shipbuilders.

DURING the present week a successful joint summer meeting of the Institution of Engineers and Shipbuilders in Scotland and the North-East Coast Institution of Engineers and Shipbuilders was held in Glasgow. Members and guests attending the meeting were received at the home of the Scottish Institution, 39, Elmbank-crescent, Glasgow, on Monday evening by Mr. A. J. Campbell and members of the Council.

The opening session took place at 10 a.m. on the morning of Tuesday, the 21st inst., in the Rankine Hall of the Institution, when an address of welcome was given by Lord Weir of Eastwood. His lordship referred to the many personal and business ties between the members of the two Institutions and the common interest in many technical problems which made it specially fitting that these two great scientific institutions should meet together. There was a kinship in the common industry, and also, he regretted to say, a kinship in the prolonged depression which had hung much too long over the industries of the Clyde and Tyne. He congratulated the North-East Coast Institution on its president of this year, Sir Eustace Tennyson d'Eyncourt, and referred to the wealth of design which was expressed by Sir Eustace in the composition of the British Navy at the close of the war. Speaking on behalf of the Scottish Institution, his lordship extended his congratulations to Sir Charles Parsons and the city of Newcastle on the very high and richly merited recognition by the King of a past president of the North-East Coast Institution. Replying on behalf of the visitors, Sir Eustace d'Eyncourt recalled his own connection with the Clyde some twenty-five years ago. The application of Sir Charles Parsons' invention of the steam turbine was, he thought, a very apt illustration of the advantages of community of effort between the Tyne and Clyde. Some reference had been made to a proposal for a closer fusion of interests between the two institutions, and with regard to that matter the North-East Coast Institution was, he felt sure, prepared to discuss any arrangement which might improve the development of the two fields of industry. Whether such an improvement would best be brought about by a fusion of the two societies or by the present friendly rivalry he was not in a position to say, but the matter was, he thought, a worthy one for discussion. Mr. A. J. Campbell, the president of the Scottish Institution, also spoke and said that they in Glasgow would be prepared to consider a closer relation with the Newcastle institution. Sir Eustace Tennyson d'Eyncourt took the chair at the first meeting and Mr. James Mollison presented a paper on "Historical References to the Progress in the Use of High-pressure Steam." In what follows an abstract of this paper is given.

THE PROGRESS OF HIGH-PRESSURE STEAM.

Recent appreciation of the advantages accruing from increases in the working pressures and temperatures of steam in both land and marine work, and the great interest provoked by the commissioning of the King George V., may render the following notes on high-pressure installations of about fifty years ago of some interest.

In comparing the normal results of those days with the concurrent high-pressure endeavours as recorded, it is found that with a fourth of the higher boiler pressure and its limited expansion, equally economical production of power was attained. Better conditions of working with high pressure, of course, would have given higher economy. There are, however, occasional records indicating a degree of economy not unsatisfactory, even compared with to-day's standard. The attempt then made to solve this problem was in the right direction, and the impossibility of carrying out a more exhaustive search at that time may be regretted. Only when the inexperience in design, workshop methods, and lack of metallurgical knowledge of that period are compared with present-day practice and experience, can the difficulties of those early experimenters be realised. Factors now established as fundamental for the economic use of steam were not in those days considered practicable. Reference might be made to forced draught, interheating and superheating systems. Even the water-tube boiler itself was not regarded with favour.

Before dealing with specific vessels of the period, equipped for extra high pressures, it may be of interest, and will make retrogression easier, to give some data concerning the general trend of the increase of working pressures for power units. In 1872, Dr. Siemens, F.R.S., President of the Institution of Mechanical Engineers, stated in Newcastle that, over a period of nine years, conditions had so improved that the marine engine consumed rather less than one-half of the amount of fuel which at the beginning of this period (1863–1872) was thought to be indispensable. Great progress was being made. Pressures at that time ranged from 40 lb. to 65 lb. per square inch, and the average consumption of coal from the recorded data from nineteen vessels was 2·11 lb. per I.H.P. per hour. The average piston speed was 376ft. per minute. In 1881, nine years later, Mr. F. C. Marshall, before the same Institution at Newcastle, dealt with the subject and showed by a comparison of working pressures and coal consumptions averaged from about forty normal steamers that the working pressure of 52·5 lb. per square inch in 1872 had increased in 1881 to 77·4 lb., while the coal consumption had been reduced from 2·11 lb. to 1·828 lb. During this time many ships were equipped with boilers having steam pressures up to 120 lb. per square inch; indeed, 90 lb. per square inch became the standard specified pressure.

Over the same period the power of the engines, the speed of vessels, and the working pressures of steam increased, while the consumption of fuel decreased.

The three outstanding vessels of that period, whose design and performance were perhaps prophetic of the trend of to-day, were the Anthracite, Wanderer and Irishman, each fitted with the type of engine and boiler developed by Loftus Perkins.

The steam yacht Anthracite, measuring 84ft. by 16ft. by 10ft., was built by the firm of Messrs. Schlesinger Davis and Co., Wallsend, and was supplied by Messrs. Hawks, Crawshaw and Sons, Gateshead, with a two-crank triple-expansion engine which developed about 168 I.H.P. at about 130 r.p.m. She made an exceptionally good run across the Atlantic, and a trial of her engines was carried out by the Board of United States Engineers (Navy Department). The report of this trial was read before the Franklin Institute—see THE ENGINEER, July 30th, 1880. Some details of the Perkins engine and boiler in the Anthracite may be given. The diameter of the high-pressure cylinder was 7¼in. and that of the medium-pressure cylinder 15⅝in., the two cylinders being in tandem. They were single acting, the high-pressure taking steam on the top and the medium-pressure on the bottom side. The cylinders were steam jacketed and had double-beat poppet valves, the high-pressure exhaust being the medium-pressure inlet, thus foreshadowing the latest advance in marine practice. The low-pressure cylinder had a diameter of 22⅝in., was double acting, steam jacketed, and fitted with a slide valve. The stroke of the engine was 15in.

It is now generally admitted that a steam jacket is not necessary. In this particular engine, the clearances were from two to four times greater than the normal practice of those days, accounting in a measure for the steam loss in filling these spaces, and in condensation on the large surfaces.

There was one boiler of the horizontal water-tube type, designed to work at a pressure of 350 lb. per square inch, the horizontal rows being connected by small vertical tubes, and arranged for superheating the steam, but the degree of superheat does not seem to have been recorded. This boiler was enclosed in a double shell of thin iron plate, the intervening space being filled with vegetable black as a non-conductor. One-half of the tube surface was generating surface, and the other half steam superheating surface. The grate was rectangular, and measured 45½in. by 49in. The outside diameter of the tubes was 3in., and the inside diameter 2¼in.

Very few troubles seem to have been experienced in the employment of high pressures, except excessive priming due to the small steam-release areas provided, and apparently no steps were taken to counteract this defect. A coal consumption of from 1·83 lb. to 1·7 lb. per I.H.P. per hour is certainly a remarkably good figure for such a small unit.

As to the steamship Irishman, there are logs and trial reports available. She was a coasting steamer measuring 153ft. by 20ft. 6in. by 12ft. 6in., and was supplied by Messrs. Blackwood and Gordon, Paisley, with geared steeple engines having a cylinder diameter of 30in. and a stroke of 30in., designed to work at a steam pressure of 20 lb. per square inch. She was lengthened 20ft. in 1863 by Messrs. Barclay and Curle, and in 1879 was reconditioned and fitted with Perkins' patent engines and boilers by Messrs. Robert Steele and Co., Greenock. These engines had cylinders of 9in., 20in., and 28¼in. in diameter respectively, with a piston stroke of 24in. The heating surface of the boiler was 938 square feet, and the grate area 22·8 square feet. At times steam pressures were used up to 500 lb. per square inch, the lowest recorded pressure being 250 lb. per square inch, when the horse-power developed was 215 at 75 revolutions per minute.

From an inspection of the logs of some forty-five voyages, the average boiler pressure was 350 lb. per square inch, and the fuel consumption 1·35 lb. per I.H.P. per hour.

The steam yacht Wanderer—see THE ENGINEER, December 10th, 1880—built in 1879, was fitted with engines having cylinder diameters of 17in., 34in., and 48in. respectively. She had four boilers, operating at a steam pressure of 350 lb. The machinery, which gave 377 I.H.P. at 77 revolutions per minute, with the remarkable coal consumption of 1·29 lb. per I.H.P. per hour, was constructed under my supervision, and I was specially instructed by Lloyd's Committee to give every attention to the engines and boilers, with a view to the vessel being classified by the Society. On April 10th, 1878, I commenced my survey. It was only after the engines and boilers were fitted on board and the trials commenced in Greenock Harbour that troubles arose, chiefly with the materials of which the valves were made. Various kinds of metal were tried in addition to Mr. Perkins' own patent metal for the low-pressure valve, which had given much trouble. Alterations had to be made to the driving gear of the low-pressure valve before a satisfactory result was achieved. Delay was occasioned, and it was only on May 15th, 1879, that the official trials took place. Immediately thereafter the vessel sailed on her maiden voyage with the owner, Mr. Charles I. Lambert, and a party of guests on board. They had not long been at sea, however, when trouble developed through defective feed-pump arrangements, and one of the four boilers was said to have become "red hot," and so alarmed the owner and those on board that they made for Southampton, where the vessel was laid up and new compound engines fitted by Messrs. Day, Summers and Co.

In concluding this paper, I should like to add that the failure of the Perkins engine and boilers in the case of the Wanderer was, in my opinion, almost entirely due to the want of efficient feed-pumping arrangements, and I have every reason to believe that if Weir's pumps had been available at that time, the working of the engines and boilers might have been attended with success, and the successful use of high-pressure steam might not have been so long delayed.

The recent application of high steam pressures to marine steam machinery is not, therefore, unprecedented, and bearing in mind the limited knowledge available over the period dealt with, it is remarkable that so much was achieved. Moreover, it is pleasing to reflect that then, as now, British engineers were in the forefront of this development.

The second paper to be taken on Tuesday was one read by Mr. Charles le Maistre, on "The Trade Value of Simplification and Standardisation in the Details of Ships and their Machinery."

Reading and discussion of papers was resumed on Tuesday morning in the Rankine Hall, when Mr. John McGovern gave a paper on "Observations on Some Economic Factors in Modern Shipbuilding"; and Mr. F. L. MacLaren dealt with the subject of "Motor Yachts and Yachting on the Clyde." On the afternoon of Tuesday and Wednesday visits were arranged to the various shipbuilding yards and engineering works of the district; and on Tuesday evening those attending the meetings were received by Lord Provost of Glasgow, Mr. David Mason, and the Corporation of Glasgow, in the City Chambers. A dinner was held at the Central Hotel on Wednesday evening, and Thursday was devoted to a cruise on the Forth of Clyde in the new high pressure turbine steamer King George V.

SIXTY YEARS AGO.

SOME interesting sidelights on the conditions of railway operation in this country sixty years ago are contained in a brief statement of the accidents which occurred in the first three months of 1867, given in our issue of June 21st of that year. Of the thirteen accidents four were caused by defective material, namely, one by a broken rail, two by broken springs, and one by a broken tire. Of the rest one was set down to wilful malice, three to neglect on the part of railway servants, and three to defective signals and station management. The twelfth accident was caused by overloading a goods engine, and the thirteenth by an excessive quantity of luggage on the roof of a passenger carriage. In another paragraph in the same issue we find some particulars of the royal train on the London and North-Western Railway, by which her Majesty Queen Victoria had recently returned from Scotland. The train was described as a model of its kind and as embodying many improvements which had been introduced by Mr. Martin, the railway company's telegraph superintendent. The improvements referred to seemingly related principally, if not wholly, to the facilities provided for signal communication between the royal compartments and the guards and driver of the train. The communication was effected electrically and involved the use of a "galvanometer" on the engine. Each compartment of the train contained a handle, which when pulled rang a bell in the guards' vans at the front and rear. The guards could communicate with each other and with the engine-driver by means of keys marked "Stop instantly" and "Stop at the next signal station." If the bell was rung it was the duty of the guards to apply their brakes and to signal to the driver by depressing the "Stop instantly" key. The driver was to acknowledge the receipt of the signal on his galvanometer by giving a short blast on his whistle and to bring the royal train to a stand. British railways at that date were passing through a crisis in their history. Eighteen of the principal companies had between them to find interest on an aggregate capital of about £290,000,000. In the issue quoted it was suggested that two things were required to restore railway property to its place—first, a termination of the expenditure which had produced the accumulation of debt represented by the capital of the companies; and, secondly, "an absolute revelation" of the state of things which had brought about the accumulation of debt. It is not very clear in what way either step was to bring about the desired result, but no doubt the railway economists of the day saw salvation in them.

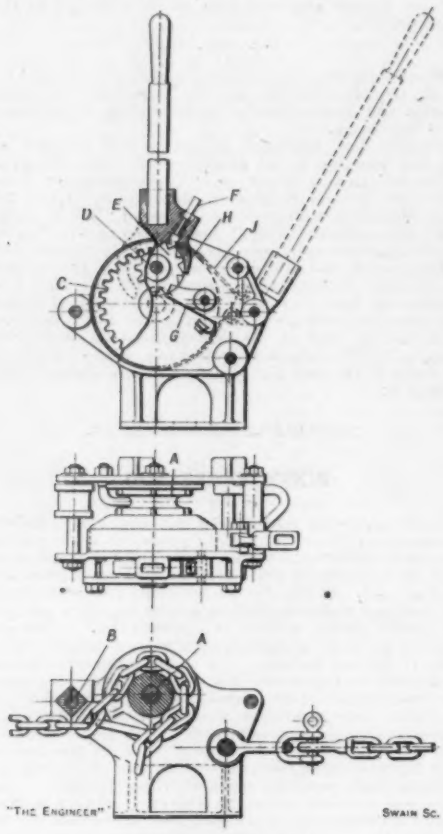
THE retirement on July 31st is announced of Mr. F. W. Wintour, the assistant mechanical engineer at Doncaster of the London and North-Eastern Railway. Mr. Wintour joined the Lancashire and Yorkshire under Mr. Barton Wright in 1883 and went to the Great Northern as London district locomotive superintendent in 1901. He is being succeeded at Doncaster by Mr. A. R. Thom, who now holds the position of "mechanical engineer, Scotland," and who, according to the official announcement, is to be "mechanical engineer, Doncaster."

ON December 13th last two freight trains were in collision on a goods loop at Orgreaves Siding, east of Darnall, on the Great Central section of the London and North-Eastern Railway. The line was not used for passenger trains, and, therefore, absolute block working was not in operation. A patchy but dense drifting fog prevailed. The driver of the first train failed to send his fireman to the box under rule 55; the thoroughness of the supervision of a ganger who should have helped the signalman was at fault; the guard of the standing train did not get out of his van in order to protect his train, and there was a weakness in the rules as to a guard's duty in foggy weather. As a result of the collision which followed the up main line was fouled by wreckage, and before it could be stopped a colliers' train ran into the obstruction. Colonel Mount inquired into the accident, and his recently issued report put upon the guard of the standing goods train "the immediate and primary responsibility for the first collision."

A Chain Pulling Jack.

A SIMPLE form of pulling jack for such purposes as removing pit props, or for jobs on which block tackle is generally used, has recently been brought out by the "Littlejack" Engineering Company, Ltd., of Quarry-lane Works, Mansfield. It is illustrated by the line drawing below.

As will be seen from the drawing the jack is virtually a little winch, which can be tied back to any convenient anchorage. Between the two side plates there is a chain wheel A, free to revolve on its pin. The chain is led round



CHAIN PULLING JACK

this wheel under a square roller B to ensure a good grip on the links. Cast with the chain wheel there is an internally toothed gear C, with which the pinion D meshes. On the pinion shaft there is a ratchet wheel E for the engagement of the pawl F on the operating lever and for the detention pawl G. The operation of pulling up with the jack is so obvious as to need no description. For lowering away, or slacking off the chain, the hand lever is pulled right over, so that the projection H lifts the pawl G clear of the ratchet wheel. The load can then be lowered under the control of the hand brake J, while the ratchet F is held clear.

The mechanical advantage given by the jack is 45 to 1, and it has the merit that it can be worked in such confined spaces that the utmost stroke of the lever is only 9in. The length of the jack is about 12in. As compared with some forms of pulling gear the jack under review has the advantage of giving a continuous pull, which is only limited by the length of chain available.

THE "Underground" system is now running a morning business train from Edgware, which omits calling at six of the sixteen intermediate stations to Charing Cross, and covers the distance in thirty minutes.

A New Rotary Pump.

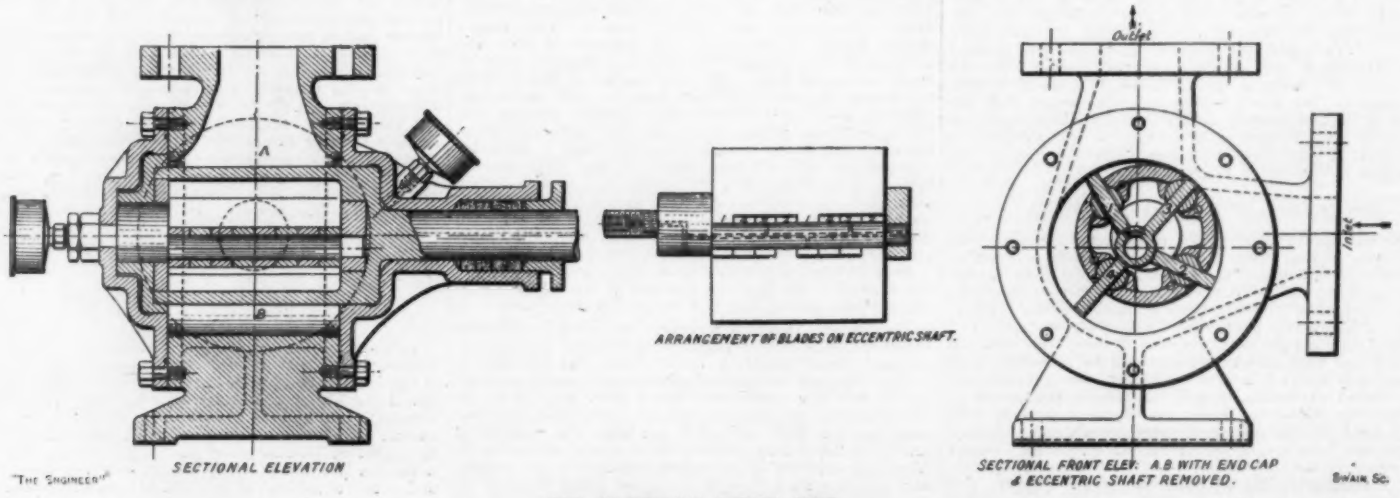
A NEW design of rotary pump has just been introduced by Ashwell and Nesbit, Ltd., of Leicester. The "Runwell" rotary pump, as it is called by its makers, is of the sliding vane type, and is illustrated in the accompanying engraving. In discussing it Ashwell and Nesbit, Ltd., point out that pumps of the rotary type are of simple construction, but that hitherto they have suffered from certain disadvantages. For example, there is wear at the ends of the blades, which is proportionate to the height of the working head, and results in comparatively early loss of efficiency in the pump in consequence of the scouring of the inner walls of the pump chamber. Various means of avoiding, or at least of minimising, this wear have been tried, such as boring out the pump chamber to keep the end travel of the blade in proportion to the angular displacement and to enable the blades, whilst subject to head pressure, to revolve without end movement. Experience has shown, Ashwell and Nesbit, Ltd., maintain, that there is no real advantage in these devices, which are costly to produce and certainly do not eradicate wear, but at best only act as palliatives.

Then again, Ashwell and Nesbit, Ltd., assert that the blades of all vane pumps, hitherto constructed, have only made line contact with the walls of the cylinder, with the result that, in them, there is but a short depth of seal, which is due to the excentric disposition of the rotor—through which the blades slide—with respect to the pump chamber. In these pumps, owing to the changing position of the line contact from one side of the blade to the other throughout a revolution, a length of blade less than the cylindrical radius is necessary to accommodate the rolling action. This leaves a gap in relation to the pump chamber into which extraneous substances are readily wedged. Where the end of a blade slides on the cylinder wall a proportion of the depth of the case must be left in the form of a strip at both sides of the port holes to support the blade across. Some makers have a strip across the centre, in addition, for the same purpose, and that entails a restriction of the free flow of fluid through the pump owing to its being impossible to merge the ports into the full depth of the case.

The "Runwell" pump, which has been evolved to surmount these disadvantages, is so well shown in the illustration that no very detailed description of it is necessary. It consists, as will be seen, of a hollow rotor excentrically placed within a chamber. Through the centre of the rotor are slots in which slide independent blades. Formed on the inner ends of these blades are bored lugs which allow of the blades being threaded on to a shaft, inside the rotor, which extends longitudinally and centrally the full depth of the case. The blades are therefore anchored, but free to revolve, their sides making contact with the ends of the chamber, but their ends just clearing the inner wall of the latter. There is thus no rubbing contact between the ends of the blades and the chamber wall, no matter at what head the pump is working.

It is claimed for the "Runwell" rotary pump (*a*) that there is no wear at the ends of the blades or of the cylinder walls, since the blades are supported on a central shaft, so that the pump has a prolonged life; (*b*) that owing to the central swinging action of the blades the radius at the end of the blades can be the radius of the cylinder, which allows of surface contact for the full thickness of the blade and thus ensures a maximum of seal; (*c*) that the close-up fit between the blade ends and the cylinder wall tends to repel rather than to wedge any substance which may be carried through with the liquid being pumped; (*d*) that the blades, being carried on a central shaft, are independent of the cylinder walls for support, and that hence the maximum depth of the case may be utilised to attain the necessary freeway through; (*e*) that the pump, though of small and compact size, combines the large capacity of the centrifugal pump with the great power exercised by the ram pump; and (*f*) that the pump provides a continuous path for the liquid being passed through it without breaking it up, so that the momentum of the moving column is utilised, which results in steady uninterrupted flow, low power and high efficiency. The makers inform us, in fact, that volumetric efficiencies at 5ft. head of 100 per cent. and a dry vacuum of 29in. have frequently been obtained. Suction lifts up to 25ft. can be worked.

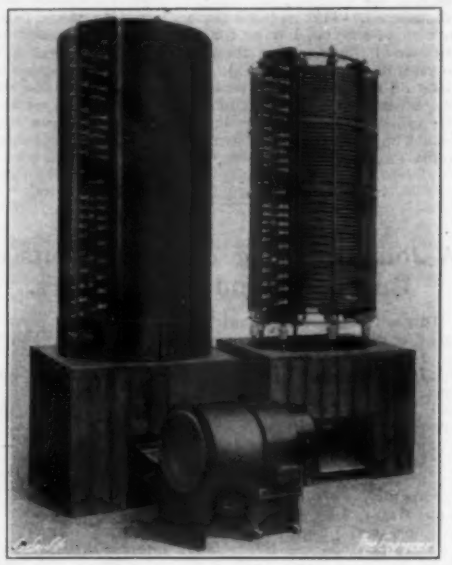
Another characteristic of the pump on which the makers lay stress is the concentration of the wear—the natural result of work done—in the swivelling blocks, which are of slightly softer material than the blades that slide through them, and the rotor on which they swivel. These swivelling blocks are, so we are informed, easily removed and changed at small cost.



THE "RUNWELL" ROTARY PUMP

Loading Reactances for Large Generators.

IN order that even the largest electric generators may be tested at the works, the Oerlikon Company has recently constructed reactance coils which make it possible to load inductively up to practically cos $\theta = 0$, single and three-phase generators of very high outputs. The motors driving the generators consequently only need develop sufficient power to cover the full-load losses, excluding in some cases the excitation of the generators and those of the reactance coils. Two of these reactances are shown in the accompanying illustration, but when a three-phase machine is being tested, three of these coils are required.



LOADING REACTANCES

In order that the eddy current losses may be small, the windings are composed of stranded copper, and as the coils are composed of sections with numerous tappings, they can be used for many different pressures and currents.

Around the inside and outside of the windings there are thick insulating cylinders composed of resinous paper, and the windings in the annular space between these cylinders are cooled by a powerful draught of air produced by a blower at the base of the coils, as shown in the illustration. For three-phase, 50-cycle loads, the coils can be used under the following conditions:—

At 2200 volts for 350 to 11,000 kVA. in about forty steps.

At 6600 volts for 3000 to 25,000 kVA. in about forty steps.

At 11,000 volts for 8500 to 45,000 kVA. in twelve steps.

At other pressures a corresponding loading is obtainable, and in the case of other frequencies the capacity ranges in the same ratio as the frequency. The use of these choking coils for loading purposes enables an accurate study to be made of the heating at full load, and it is possible to determine the efficiency much more accurately than when it is based on the light load and short-circuit losses, because in the case of large units the eddy current losses which occur under short-circuit conditions are much smaller than when the plant is working at the normal pressure.

INTEREST in the possible establishment of new dock facilities on the river Tees has been revived at Middlesbrough. Now that the Tees Commissioners have decided upon a comprehensive scheme of deepening and widening the river, it seems probable that the railway company will again consider the question of dock facilities.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Improved Market.

INDUSTRIAL conditions in the Midlands and Staffordshire show no appreciable change, but I am happy to state, market conditions show a certain amount of improvement. Price deterioration appears to have run its course, the market tone has firmed up somewhat and buying, particularly in the steel department, has improved even to the extent of some careful contracting. It must not be assumed that business on Birmingham Exchange this week was good, far from it. The amount of orders given out was not large, but it was just sufficient to lead one to believe that the general policy of abstention was being discarded and that freer buying in the future might be expected. There are, of course, consumers of iron and steel who consider the downward movement in prices will continue still further, and they place orders only against immediate requirements. In the steel department continental supplies continue to find their way into this district in considerable volume, with the tendency towards the finished article increasing; buyers are not contracting so freely as they did, however. Fuel prices are easier, coke values weak. Plenty of spot lots are to be bought cheaply. Prices of fuel are now approximating to the pre-strike level. The iron and steel industry and general engineering branches throughout the Midlands and Staffordshire remain consistently dull, and it is difficult to see what, at this period of the year, is likely to occur to reinvigorate them.

Steel.

Some amendment in demand for steel is to be noted this week, and it is reported that quite an appreciable amount of forward business has been placed with Midland steel works. Many engineers, it would appear, have come to the conclsuion that there is little, if anything, to be gained by further delay in placing their orders, price lessening having, in their opinion, nearly finished. Steel masters and merchants certainly adhere firmly to recognised quotations despite the fact that new orders are not being arranged in sufficient quantity to balance the heavy output. As a matter of fact, now that in many cases arrears have been worked off, orders will have to come in much better than they are doing if plants are to be kept running. Particularly does this apply to the plate mills, where work is decidedly scarce. Makers of sections are in rather a better position. The demand for building steel keeps up fairly well from the constructional engineering department, and engineers have little or no difficulty in getting supplies of joists and sections. Some fairly large inquiries are in the market for reconstruction schemes, but the tonnages involved are comparatively small. Angles and joists continue to be quoted £7 12s. 6d.; ship, bridge and tank plates £8 7s. 6d., while boiler plates range from £11 to £11 10s. Staffordshire hoops are £10 10s. at works. Makers of tool steels find business fairly brisk, but competition is keen for the orders that are being given out. Small steel bars are quoted £8 and soft billets £6 15s. Staffordshire re-rollers of continental material are no better off than they have been in the reaction of the past two or three months. Midland engineers are receiving tempting offers of cheap continental steel. Joists have been quoted as low as £4 17s. 6d. f.o.b. Antwerp. A good deal of this material finds its way into this country, no fewer than 16,581 tons of steel girders, beams, &c., being imported in May, although the April tonnage was 21,635 tons. Continental prices generally are unchanged, the slight fluctuations experienced during the past few weeks not showing any definite tendency.

Raw Iron.

The pig iron position is still very quiet, though some smelters report a slight advancement in buying since the holidays. Prices are now at a low ebb, makers accepting £3 10s. for Derbyshire No. 3 foundry and £3 5s. for Northamptonshire. Nevertheless, consumers are only buying such quantities as will tide them over, in the hope that iron will be cheaper in the future. True, the price tendency in this department, as in blast-furnace coke, is downward; but it would appear that rock-bottom quotations have been practically reached. At any rate, that opinion is held by very many Birmingham merchants and particularly as regards fuel. Demand for forge iron appears to have ceased, and it is difficult to get reliable quotations. Those given are purely nominal. Any business offered would be the subject of price negotiation. It is reasonable to assume, however, that proportionate reductions to those made in foundry grades would apply. It is pleasing to note, especially under present almost stagnant conditions, that the production of pig iron last month—720,100 tons—was the highest this year, and higher than it has been for a long time, although five furnaces went out of action during the period. Exports are also nearly double what they were in April, the May total of foundry iron being 12,946 tons, as compared with 6695 tons in the previous month. After the drastic cuts which have been made in iron prices during the last few weeks the returns should continue to show improvement. On the other hand, imports of foundry iron totalled 18,684 tons, as compared with 20,916 tons in April. These are encouraging figures, which help to counteract the dismal tone of the market.

Staffordshire Bar Iron.

The Staffordshire finished iron trade does not show any improvement. Most of the mills have been at work this week, but there is apparently no substantial reserve of orders. Reports as to the future prospects are not very reassuring, but some re-invigoration is hoped for from railway contracts for which tenders have been sent in. Meanwhile the trade has not anything like sufficient orders to employ its resources. Business in this department, as in pig iron, is being done on the hand-to-mouth principle, the recent reduction in prices having availed nothing towards inducing the placing of forward contracts. Though quotations this week are generally unaltered, it is stated that weakness is discernible in many quarters where it is least expected, and that any offers of substantial business would be immediately met as regards price. Lancashire houses competing for the Crown bar trade continue to offer supplies at £10 15s., and local makers would perforce accept a similar figure. There is little business going to anyone, however. Consumers of nut and bolt and fencing iron are drawing their supplies from continental sources almost to the exclusion of native mills. The call for iron tube strip has not been good of late, but the reduction of 10s. a week ago, bringing the price to £12, has had the effect of slightly bettering the demand.

Galvanised Sheets.

Galvanised sheets have lost ground during the week. Mills have accepted £14 10s. for good-sized orders, though makers who are relatively well booked refuse to entertain less than £14 12s. 6d. for 24-gauge galvanised corrugateds. Overseas inquiry makes up for the rather moderate demand of home consumers.

Pit Committee Established.

In its report on the coal industry last year the Royal Commission made a strong plea for the setting up of pit committees. It expressed the opinion that in many cases the workers could assist the management in many practical details regarding which they were experts. The committees would be likely to stimulate production and in other ways to promote the best interests of the undertaking. To West Cannock Colliery, Hednesford, falls the credit of setting up a live pit committee, constituted of the checkweighmen and one workman from each of the pits of the company and the various officials. This pit committee meets each month—in the directors' room at the colliery offices. There is a round table conference on matters affecting both parties, the three main heads of the questions discussed being safety, economy and output, in the order mentioned. It is authoritatively stated that nothing is kept from the men. Details of the working costs, selling prices, &c., are put on the table, and if the workmen's representatives require any information which is not immediately available it is procured for them as soon as possible. The committee is operating excellently, and there can be no doubt but that a distinct step has been made in Cannock Chase coalfield towards an improvement in the industry and the promoting of a spirit of goodwill between masters and men.

Unemployment.

The adverse effect upon employment caused by the holiday period has subsided, and most recent unemployment returns show a substantial decrease upon the figures issued for the previous week. The total of the live register now stands at 144,744, as compared with 169,626, but that decrease does not quite bring back the total to the position before Whitsuntide, when it was 139,872. The position in the Birmingham area is slightly better than before the holidays. Now there are 21,426 unemployed, as compared with 21,473 on May 30th.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Heavy Textile Plant Shipments.

LAST month's shipments of British textile machinery were more satisfactory than they have been for a long time. Valued at £1,180,000, exports in May compare with £838,141 in the previous month, £606,789 in the corresponding month of last year—a period, however, which was probably seriously influenced by the coal stoppage—and £1,101,400 in May, 1925. Of last month's shipments, spinning and twisting machinery was responsible for £933,384 and weaving machinery for £174,533. With the exception of the South American outlets all the overseas markets for this branch of engineering took consignments to a higher value than either in the previous month or in May of last year. During the period under review the British East Indies was the largest buyer with £233,176 worth, although Russia came fairly close with £217,437. Holland came next with £87,529, France with £81,864, Japan with £72,236, Germany with £60,849, the United States with £57,872, South America with £54,631, Australia with £36,498, and China with £25,889, "Other European Countries" taking in the aggregate exports to the value of £180,000.

Credits and "Understandings."

Credits for Russia for the purchase of more textile machinery from makers of such plant in this district, and proposed price "understandings" between Lancashire textile machinists, have been the subject of Press rumours this week. In neither case, however, is the position anything but obscure at the moment. The Russian credits story originated in a message from Berlin at the beginning of the week to the effect that an agreement had been reached under which Tweedales and Smalley, Ltd., Rochdale, and Platt Brothers, Ltd., Oldham, who are among the largest makers of textile machinery in Lancashire, had arranged to grant credits amounting to £2,500,000 over a period of two to three and a-half years for the supply of textile plant to Russia. Official statements by representatives of the two firms deny that any such arrangement has been made, though Messrs. Tweedales and Smalley add that they have agents in Germany, and that it is quite possible that negotiations which were in progress before the severance of diplomatic relations between Great Britain and Russia may now be resumed. With regard to the question of a price-fixing arrangement—for that is what the other matter boils down to—here again, the position is very vague. According to one report, the suggestion has been made that a central board, consisting of a representative from each directorate, should meet to consider such questions as selling prices of textile machinery, the reduction of overhead charges, and the credits to be granted to foreign customers. The larger firms have disclaimed any responsibility for the proposal, which, it is suggested, has been put forward by one of the smaller concerns engaged in the industry.

Rd. Johnson, Clapham and Morris, Ltd.

The reference which I made in my last week's letter to Rd. Johnson, Clapham and Morris, Ltd., has, I find, been taken to mean that they were only iron and steel merchants. That, of course, is very far from being the fact, for the firm has, in addition, a substantial manufacturing business, and makes, among a host of other things, such varied products as wire work for all industries, cutlery and edge tools, miners' lamps, and galvanised corrugated iron.

The Wages Problem.

Engineering trade employees in the Manchester district, the largest centre of the industry in the country, have organised a series of meetings to consider the wages offer of the employers, and the nineteen unions affected in this area have been requested not to ballot their members until the meetings have taken place. The first is to be held at Stockport on Tuesday of next week, and the remainder in other parts of the district between July 3rd and 10th.

Non-ferrous Metals.

Probably the most important feature in the non-ferrous metal market since last report has been the rise and fall in copper, with values at the moment of writing at a particularly low level. A poor demand from both domestic and continental consumers of the metal, coupled with the news of higher stocks at refineries in the United States, has been sufficient to "bear" the market pretty severely. The feeling is, moreover, that until the European selling prices of the American export organisation are on a parity with those ruling in the United States, buying over here will be limited to filling bare requirements. The trade demand for tin has continued on quiet lines, but a further important reduction of stocks at English ports disclosed by the latest statistics has had a markedly strengthening effect on the value of the metal for prompt delivery, the result being a gain of rather more than £1 a ton compared with a week ago. Supplies of both lead and spelter have been greatly in excess of the market requirements, and the result has been a fairly substantial fall in each case. There is the usual talk of curtailing output, but it has not been sufficiently convincing yet to furnish any strength to the market.

Iron.

A welcome development in the market for pig iron here has been a very slight improvement in the volume of inquiry and rather more actual forward business done. In view of the long-continued abstention from buying so far as new orders of any weight are concerned, and in view also of the severe fall in prices during the past month or so, an expansion was not unexpected, but sellers are not prepared to say how far the improvement will develop or for how long it will last. It is certain that prices cannot fall much below present levels, though producers are strenuously resisting attempts on the part of buyers to depress them further, and it is reported that orders have been refused because of very narrow differences. This week Staffordshire makes have been quoted here at from 77s. 6d. to 78s. 6d., with Derbyshire at about 78s., Middlesbrough at 83s., Scottish at 96s., and East and West Coast hematites at 92s., including delivery to Manchester or equal in each case. Lancashire bar iron keeps steady and no change in official prices has been made, Crown quality offering at £11 and seconds at £10 per ton. Inquiry, however, continues on a very restricted scale and short-time working at the Lancashire forges is the general rule.

Steel.

The demand for steel is poor and practically the whole of the orders that are being placed are for early delivery. Users are looking for a fall in prices, and are not anxious to enter into fresh commitments for any lengthy period. In the meantime, boiler plates are offering at about £11 5s. per ton, with ship and tank plates at £8 7s. 6d., joists and sections at £7 12s. 6d., and steel bars at from £8 2s. 6d. to £8 15s. There is little response to the offers of imported steel products, and the demand, both for finished and semi-finished material, is slow. The latter has shown further fresh weakness, and sheet bars are now obtainable at about £5 7s. 6d., billets at £5 2s. 6d. to £5 5s., steel bars at £5 15s., wire rods at £6 12s. 6d. to £6 15s., sections at £5 15s. to £5 17s. 6d., Siemens plates at £7 7s. 6d., and ordinary plates at £7 to £7 2s. 6d. for net cash against shipping documents and including delivery to buyers' works in the Lancashire area. For galvanised sheets there has been little business stirring during the past week, and values are now down to £14 10s. per ton for 24 gauge materials. Thin gauges are also weaker, and are now quoted at £22 12s. 6d. for Rangoons, £20 15s. for Straits, £21 15s. for Bangkoks, and £23 for Shanghais, but there is little buying for any of these markets.

BARROW-IN-FURNESS.

Hematite.

There is a decided flatness in the hematite pig iron market which is accounted for with difficulty. The bottom seems to have fallen out of the trade, and with the present number of furnaces in blast, stocks will accumulate rapidly. Customers are not placing, by any means, large orders, and, in fact, small parcels of iron constitute most of the deliveries. This sudden falling off may be attributed to several causes. One cause may be that foreign competition is interfering with English trade; another that customers now hold large stocks; while another is that buyers are holding off until the last moment. There will certainly have to be an immediate improvement or a serious curtailment of output will have to be faced.

Unless orders are immediately forthcoming, a number of furnaces will certainly go out of blast within a very short time. The iron ore trade is seriously affected throughout the district, and much less ore is now being brought to the surface. Imports of foreign ore are similarly affected. The steel trade is dull, and within the next few weeks there will be several interruptions in the output in Cumberland. As regards Barrow, the steel works engaged upon rails, &c., have enough orders at present to take them on to the August holidays, but what will happen after that date, it is impossible at the moment to state. The hoop and small section mills are better placed.

SHEFFIELD.

(From our own Correspondent.)

The Output of Steel.

THE large plants producing raw and semi-manufactured steel in this district are not as fully employed as they were in the first months after the settlement of the coal dispute, but, although it has been necessary to close some of the furnaces, output is still on a large scale. Some inquiries made last week as to the number of furnaces in commission in the different parts of this area, and their production, elicited the following figures:—Sheffield, twenty-two furnaces, with an output of 6000 tons per week; Lincolnshire, eleven furnaces, 10,000 tons; Rotherham, eighteen furnaces, 11,000 tons; Penistone and Stocksbridge, six furnaces, 3500 tons. The average production of the furnaces in Sheffield itself is low, as compared with those in the surrounding neighbourhood, but that is accounted for by the fact that they are not, as a rule, charged up to full capacity and that their output is restricted by reason of the special quality of steel produced. How long the present substantial production of the district can be maintained is a matter that is causing some anxiety. The complaint that orders are not coming forward in bulk to take the place of those that are worked off is still general. Users are very short of stocks, but they are showing great unwillingness to place forward contracts. That is no doubt due to uncertainty as to prices, which continue on the easy side, and it is not difficult to obtain concessions from the ordinary quotations when a substantial firm offer is in question. At the same time, it is believed that a good deal of valuable work is being held up until the market becomes stable.

Some Works Busier.

In the heavy finished steel departments increased activity is reported. Several of the large works are well employed, especially those of Vickers Ltd., Cammell Laird and Co., Ltd., and Metropolitan-Vickers, Ltd., at which a good deal of overtime is being worked. The improvement, however, is not by any means general. The automobile industry, which has been one of the most important feeders of Sheffield for a long time, is still furnishing the city with a valuable amount of work in steel, springs, forgings, castings and a variety of steel parts, but the volume of the orders coming to hand at present does not equal that of last year. The rolling mills had slightly more work on their books when they resumed after the holiday. A disappointing branch is that which is concerned with the building of railway wagons, for which few orders have been received from private owners this year. There is, however, a large amount of repair work on hand.

Cutlery and Plate.

The report with regard to the colonial side of these trades is a great deal better than that which relates to the home demand. The value of the cutlery exports for May was £93,000, the largest total for several years. It exceeded that of the previous month and also of the corresponding month of last year, by £20,000. There was a very satisfactory increase in safety razors and blades, the exports of which, during the five months of this year, have represented a value of £85,000. Scissors also showed an improvement, and there was a small gain in knives. The largest trade was again done with Australia, Canada being the second best market and India the third. Some improvement was shown in the returns for both the United States and South America. The imports of cutlery were less in May than in April, but the five months' total is a good deal larger than that of 1926. Shipments to the Colonies are still being well maintained. There is a growing demand overseas for cheap goods, and in order to meet it some firms have succeeded in cutting down their prices for stainless knives. There is a good demand for cutlery and plate for the outfit of ships and hotels, but the ordinary home trade is very depressed. Electro-plate makers do not remember a time when the call for hollow-ware was so poor. The War Office, which last year placed a contract for safety razors with the Gillette Company without giving British makers an opportunity of tendering, has now adopted a standard pattern, of British make throughout, which is to be served out to the troops in future, and the next contract will be offered to public competition.

A New Steel Foundry.

A new steel foundry, in which many interesting labour-saving devices are adopted, has just been completed at the Grimesthorpe Works of Cammell Laird and Co., Ltd. It is designed to deal specially with the production of small castings. Primarily its lay-out was intended for the production of castings from 10 lb. to 1½ tons, but since the scheme was started developments have been made which have brought the capacity of the new establishment up to 5 tons. It is designed to produce 200 tons of castings per week. One of the most interesting features is the sand-mixing plant. The sand bunker has an oblong box neck protruded over the top of the mixing basin. The box holds exactly 1 cwt. of sand, and has sliding panels at its top and bottom, so that it is easy to "cut off" as many hundredweights as are required for a particular mix. The oil and water are measured in a glass gauge, a spinner mixes them, and the oil mixture is then run into the basin, where it is churned up with the sand by revolving arms. The actual amount of manual labour involved in the operation does not occupy more than a few minutes, and there is no dirt and no waste of either oil or sand. The casting process brings another novel labour-saving device into operation. Cranes convey the moulds into the required position in the casting bay. The whole box is dropped on to a knock-out grid running the length of the bay, and under it moves a continuous conveyor to carry away the sand, &c., and to sift and clean it for re-use. The stripping work is done by a 2-ton crane, which moves over the grid. Arms at the sides pick up the boxes, drop them, turn them over, and drop them again if the first blow has not loosened the contents. A ramming rod completes the clearance, and then a magnet draws the casting from the *débris* and deposits in on a truck for removal when the load is completed. The arms of the crane finish the task by piling the boxes in tidy heaps for wholesale re-distribution. The whole of this operation is under the control of one man. This ingenious stripping crane is one of the inventions of the company's staff. The annealing gas-fired furnace provides an example of heat and fuel economy. The pre-heating chamber is heated by the gas that comes from the annealing chamber, and the heat taken out of the casting in the cooling chamber is used for combustion in the annealing chamber.

New Coke Oven Plant.

John Brown and Co., Ltd., of Sheffield and Clydebank, announces that the pithead alterations at their Aldwarke Colliery are proving satisfactory, and that, in order to obtain economies in coke manufacture, they have decided to recondition the coke oven plant at Rotherham Main on new and improved lines. In their annual report the directors state that the trading results of every branch of the business were most seriously affected by the coal dispute of last year. It was considered advisable to continue operations at the Atlas Works, Sheffield, with the aid of high-priced foreign coal rather than cease work there altogether. The company was thus enabled to carry out its contracts, although a serious loss was inevitably sustained in so doing. In addition to this, the steel trade of the company is still suffering most severely from foreign competition, due to the low wages and longer hours prevailing abroad. Towards meeting the abnormal loss due to the coal dispute, the directors have appropriated £175,000 from the contingency account. Apart from that appropriation, the net profit for the year was £6589. For the second year in succession there is no dividend on the ordinary shares.

NORTH OF ENGLAND.

(From our own Correspondent.)

Cleveland Iron Trade.

BUSINESS in the Cleveland pig iron trade is likely to rule on the quiet side for the next few weeks. The annual holidays in Northumberland this week mark the beginning of a series of seasonal interruptions which tend to restrict transactions. This also is the stocktaking period when works prefer to reduce their purchases to the minimum, and the consequence is that the volume of business done during the past few days has been very limited. Nevertheless, there are some hopeful factors. Foreign shipments are on a rising scale, and if Scottish consumers are still buying very sparingly, it is believed that the demand north of the Tweed will improve as soon as existing contracts with the Continent have been completed. While forward contracts of importance are not being arranged, it is gratifying to learn that inquiries are no longer entirely confined to parcels for early delivery. Continental competition, though slightly less keen in certain branches, is still difficult to contend with. Values of foreign products are firmer, but they are still such as keep makers here out of certain markets. Cleveland prices are firmly maintained, No. 1 foundry being 72s. 6d.; No. 3 G.M.B., 70s.; No. 4 foundry, 69s.; and No. 4 forge, 68s. 6d. per ton.

Hematite Pig Iron.

There is still only a very limited demand for East Coast hematite pig iron, and heavy stocks still remain on makers' hands. But it would appear that we are now getting down to a competitive level as a number of inquiries from the Continent have been in circulation this week for hematite. Prices vary, but 77s. 6d. per ton is about an average figure for East Coast mixed numbers, and 78s. for No. 1 quality.

Ironmaking Materials.

One satisfactory feature from the standpoint of pig iron producers is the continual fall in fuel prices. It is now possible to buy good Durham furnace coke delivered at local works at 20s. per ton, and this should offer opportunity of some perceptible relief in the cost of production. Sellers of foreign ore report an idle market. Works decline to buy with the outlook so uncertain, but prices keep firm and are based on best Rubio ore at 22s. per ton c.i.f.

Manufactured Iron and Steel.

The manufactured iron and steel trade is without any new feature of moment. Certain manufactures are in slightly better request, but sales fall vastly short of what is necessary to keep the works actively employed. Prices are firm and unchanged.

The Coal Trade.

It seems almost certain that, in the near future, the curtailment of output at Northumberland and Durham collieries will be reflected in the general state of the market, by reason of certain pits closing and others working one shift per day instead of two. A steadying effect on prices may be expected, and this will not be without its influence when merchants come to cover their requirements in respect of contracts recently negotiated. Durham, perhaps, will be less sensitive in this respect than Northumberland, because trade is so dull, but there are signs that some grades of gas and coking fuel are in better request. Northumberland steams are well booked to the end of the month, and values are steady for all descriptions. If new trade should come along in anything like volume, it would, with the lessened production, very soon harden prices. The French decree, with regard to the importation of coal, is not likely to be so serious in effect as was at first anticipated. The Tyne ships about 150,000 tons of coal per month to France, and the Wear and Blyth about 50,000 tons per month each, which amounts to about 3,000,000 tons a year. It was believed in some quarters that shipments might be cut down to a third under the new conditions. It is not likely, however, that the effect of the measure will be so far-reaching as that, for, up to the present, at any rate, licences have been granted fairly freely, and so considerable loadings are assured for the next two or three weeks. The success which attended merchants' tenders in this area for the Swedish State Railways' contract was very encouraging to the Northern industry. Out of a total allocation of 196,500 tons to be delivered to the end of September, Northumberland will supply 97,000 tons and Durham 31,000 tons. The prices range from 17s. 9d. to 20s. 9d. per ton c.i.f., and it would appear that merchants have discounted both current values of coal and freights in their eagerness to participate in the order, but the trade has been captured, and it is significant that only a modicum of the contract has gone to Germany.

Coal Market Position Quiet,

There is no special change to record in the coal market. This week business has been interrupted owing to holiday influences, and merchants have covered their general requirements for the time being. For next month there is a fairly good inquiry, and fitters are inclined to hold off the market. Shippers, also, while sounding the market, appear inclined to hold off until the turn of the half-year. There is, therefore, nothing passing to test actual values for forward shipment. Best Northumberland steams are fully 14s. 6d., and secondary qualities, 13s. 6d. Best Durham steams are quiet and nominal at 17s. to 17s. 6d. for large, and 12s. 6d. for smalls. For gas coal, supplies are in excess of requirements, and, although producers ask recent prices, the tone for spot shipment is easy. Forward prices are holding, best qualities at 16s. 9d., and secondary at 14s. to 14s. 6d. The bunker trade is more active, and all qualities are steadily quoted, good Durham unscreened at 14s. to 14s. 6d., and best kinds at 15s. to 15s. 6d. Gas coke is fully booked up to the end of the month, and makers quote steadily for July shipments, as stocks are low. Best makes are at 19s. 6d. Beehive coke is in limited supply at 30s. to 32s. 6d. Patent cokes are a slow trade; ordinary at about 20s.; superior makes, 25s. to 26s.

SCOTLAND.

(From our own Correspondent.)

Continued Depression.

IN the steel and iron markets buyers continue to show a complete lack of confidence and conditions remain quiet and depressed. The demand has not increased as expected, in fact there has been practically no forward movement, and the degree of optimism apparent some months ago has been almost entirely dissipated meantime. It appears feasible that, considering the amount of business placed with Clyde shipyards, better conditions might be anticipated, but it would seem as though operations at the yards are moving more slowly so far as the laying down of new keels is concerned. At any rate, the flow of fresh business is most disappointing, and many are becoming apprehensive as to employment in the near future. The coal market, likewise, is in a very dull condition, and prospects are not improving. Taking the steel, iron, and coal markets together, the outlook cannot be termed as anything less than problematical.

Steel.

Many, if not all, of the steel works must now have overtaken arrears of deliveries caused by last year's coal strike and are now feeling the lack of fresh orders. Some producers of heavy steel are still comparatively well employed, but consumers generally are not now pressing for deliveries to the same extent as formerly, and production is slowing down. Buyers are not inclined to purchase far ahead, and the orders placed for early delivery are, as a rule, restricted in amount. Prices are unchanged.

Steel Sheets.

Latest reports indicate a shortage of business in heavy gauges and also for inferior qualities, but some producers of black and galvanised sheets are fully sold for June and July in black and galvanised descriptions, and a firm level of prices is maintained.

Bar Iron.

Bar iron makers are finding great difficulty in keeping their mills employed, despite recent reductions in prices. Demands from all sources are very limited. Similar conditions prevail in the re-rolled steel departments. Bar iron is nominally quoted £10 15s. per ton home and £10 10s. export, but the latter figure can be shaded. Re-rolled steel bars are named £8 2s. 6d. home and £7 17s. 6d. per ton export, but the export quotation is mostly a matter of arrangement.

Pig Iron.

The demand for pig iron is strictly limited both for hematite and foundry qualities. Stocks are accumulating at makers' yards and there appears every probability that prices will continue to weaken.

Imports and Exports.

There was a further decrease in the importation of iron ore at Glasgow last week, and the total amount did not exceed 11,500 tons. Iron imports showed a slight

improvement at 2900 tons. Exports of iron reached a total of 7000 tons, the largest portions of which were for Australia and Natal. Smaller quantities went to Calcutta, New Zealand, the Straits Settlements, and South America. Considerable quantities of machinery, structural material, pipes, and tubes also were despatched to most of the above-mentioned destinations.

Coal.

The feature of the coal market during the past week was the placing by the Swedish State Railways of contracts for delivery from June to September. The amount allocated to Scotland is comparatively small, but is nevertheless welcome. The amount includes 42,500 tons of Cowdenbeath—Lochgelly—Glencraig steam coal and 18,000 tons of Wellbeath (Wemyss) Navigation coal. Conditions otherwise are unchanged and the combined demand on home and export account does not absorb the restricted production. With the exception of Lanarkshire splints, all-round fuels are inactive, and weaker in price. Washed nuts maintain their firmness owing to a scarcity of supplies. It is probable that more pits will be compelled to close down. Aggregate shipments amounted to 225,039 tons, against 234,269 in the preceding week and 203,295 tons in the same week in 1925.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Position.

THERE has been no improvement in the general state of the coal industry of this district since writing a week ago. A much larger current demand is required to put life into business and enable numerous collieries to dispose of their standing stocks. Very few undertakings are well enough off for prompt orders to permit them to maintain regularity of work at the pits, while reports of miners being given notice to terminate their contracts are of almost daily occurrence. It does not always follow that this means a suspension of operations at the collieries at which they work, as there is always the chance meantime of the undertakings in question getting business which will justify them continuing work at the pit. The position is, however, a very precarious one, for most collieries, and unfortunately the lowering of prices does not bring any more business. Of course, the returns of exports for the week ending June 17th last showed a marked improvement upon those of the previous week, which was Whitsuntide, the figures being 518,152 tons, as against 354,331 tons. At the same time the total for last week rather indicates that there is more being done in the export trade than the present apparent dullness leads one to suppose. The almost daily report is that the docks are easy—that is, that the tonnage supply is inadequate for requirements—but there is this to be said, that steamers arriving are getting a relatively quicker turn than they would if the docks were congested. Certainly more orders and tonnage could be dealt with. The returns as to the state of the docks at the end of last week show that there were altogether thirty-six idle loading berths, while on Monday last the situation was not better, as there were thirty-seven idle loading appliances, which shows that the arrivals of tonnage over the week-end barely balanced the outgoing steamers.

Coal Exports to France.

There is a slightly easier feeling prevailing regarding the shipments of coals to France, and the latest reports are that probably in a few months' time, or even at an earlier date, the system of only allowing coal to be imported into France under licence will be dropped. The announcement in Parliament last week that the French authorities had issued licences for the importation from the United Kingdom during the three months June, July and August of at least 2,800,000 tons, a quantity in excess of the average monthly quantity to France this year, afforded some satisfaction, though it has not removed the existing disquietude. The reason for this is that although such licences have been issued it does not necessarily follow that shipments up to that full amount will be effected. It all depends to whom such licences have been issued. It is quite natural for French importers to apply for a licence to ship a greater quantity than they would do in ordinary circumstances, in the belief that such quantity may be curtailed by the authorities. Quite apart from this, it is acknowledged that the purpose of the steps taken by the French authorities is to cut down the imports of coal for the State Railways and other public undertakings, but as regards other requirements inquiries go to show that there is no difficulty in getting licences. Local firms which have contracts for the supply of coal to French State Railways are very reluctant to state what their exact position is. It is well known, however, that their monthly deliveries have been cut down, and there is a suspicion that in order to keep in favour they have had to submit to the inevitable and accept a reduction in their contracts. The feeling exists that France has not improved her position, and it may be that, appreciating this, steps will be taken before very long to bring the system of licences to an end. By that time the French Government will probably be able to say that the object has been achieved, namely, the removal of the fear of unemployment in the French coalfield. At the same time the view is held that if the reason for the restriction of coal imports is the prevention of unemployment then a very easy way to relieve this would be to repatriate the alien miners who are employed, their number being estimated at round about 30,000. In a statement issued by the secretary of the South Wales Coalowners' Association he points out that one of the reasons given in defence of the decree is that at the present price level the imports of foreign coal, and particularly those of the United Kingdom, are a menace to the continuance of work at the French collieries. The unconvincing character of this argument could be easily exposed by the French statistics of production and consumption up to the end of April last. But his immediate object is to draw attention to the fact that under the conditions that exist at the moment the decree is in effect, if not in avowed intention, a measure to penalise British coals by providing artificial protection for French coal prices and therefore for French colliery profits. He has ascertained that the balance sheets of the principal French collieries for financial years ending in 1925 and 1926 show the following net results in million francs:—Aniche, 1925, 22·6; 1926, 42·1; Lens, 1925, 37·9; 1926, 50·3; Anzin, 1925, 25·9; 1926, 46·3; Courrieres, 1925, 32·4; 1926, 53·9; Dourges, 1925, 15·3; 1926, 21·5; Lievin, 1925, 7·5; 1926, 15·2; Saar and Moselle, 1925, 15·3; 1926, 18·7. Mr. Finlay Gibson, the coal-owners' secretary, adds that the above are disclosed profits, but there has been simultaneously an enormous expenditure of a capital character which has been met entirely out of profits.

Current Business.

The tone of the steam coal market remains unchanged and is quiet for all descriptions with the exception of sized qualities. The latter are very steady, and the reason for this is that, although under the eight hours' day production of coals is higher, the facilities of collieries to turn out relatively greater quantities of sized coals have not been increased. Large coals, however, are very irregular in quotation, but the very best quality does not command more than 21s. 6d. at the moment. Smalls meet with an inquiry which is not equal to more than just about keeping them steady. Patent fuel is not so well off for orders as during the past month, but there is no alteration in coke. As regards the Belgian State Railways inquiry for about 30,000 to 40,000 tons of large coals, it is reported that the business has been placed in the North. Pitwood is a shade steadier at round about 31s. owing to the reduced quantities being imported.

LAUNCHES AND TRIAL TRIPS.

ERARTA, steel port lighter; built by Harland and Wolff, Ltd., to the order of Argentine Navigation Company (Nicholas Mihanovich), Ltd., Buenos Aires; dimensions, 90ft. long, 28ft. beam, and 7ft. 6in. deep; to carry 350 tons on a 7ft. draught; launch, June 14th.

LADY WILSON, steam pilot vessel; built by Lobnitz and Co., Ltd., to the order of Bombay Port Trust; dimensions, 145ft. by 26ft. by 12ft. 6in. Engines, triple-expansion direct-acting surface condensing; launch, June 14th.

TEAKWOOD, oil tanker; built by Sir W. G. Armstrong, Whitworth and Co., Ltd., to the order of Teakwood Steamship Company (1926), Ltd.; dimensions, 415ft. by 54ft. 6in. by 31ft. 6in.; to carry 8825 tons deadweight. Engines, triple-expansion, 27in., 45in. and 75in. by 48in. stroke, pressure 180 lb. per square inch; constructed by Wallsend Slipway and Engineering Company, Ltd.; launch, June 15th.

AGATHA, twin-screw motor vessel; built by Harland and Wolff, Ltd., to the order of Anglo-Saxon Petroleum Company, Ltd.; dimensions, 305ft. by 50ft. by 19ft. 3in.; to carry petroleum in bulk. Engines, two sets of single-acting, four-stroke cycle, six-cylinder Harland-B. and W. Diesel engines; launch, June 16th.

BRIXTON, steel screw collier; built by S. P. Austin and Son, Ltd., Sunderland, to the order of South Metropolitan Gas Company, Ltd.; dimensions, 244ft. by 36ft. 3in. by 20ft. 6in.; to carry 2440 tons deadweight. Engines, triple-expansion, 16in., 30in. and 49in. by 36in. stroke, pressure 180 lb. per square inch; constructed by North-Eastern Marine Company, Ltd.; launch, June 16th.

GRANTLEYHALL, single-screw steamship; built by Harland and Wolff, Ltd., to the order of West Hartlepool Steam Navigation Company, Ltd.; dimensions, 427ft. by 55ft. 8in. by 38ft. 0¼in., with a gross tonnage 5000 tons. Engines, triple-expansion, 27in., 44in. and 73in. by 48in. stroke, pressure 180 lb. per square inch; launch, June 16th.

JUNA, steel twin-screw steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of British India Steam Navigation Company, Ltd.; dimensions, 290ft. by 43ft. 6in.; to carry 2000 tons deadweight. Engines, two sets triple-expansion, burning oil fuel; constructed by Swan, Hunter and Wigham Richardson, Ltd., Neptune Works; a speed of over 14 knots was attained on trial trip recently.

LAURENTIC, triple-screw steamer; built by Harland and Wolff, Ltd.; to the order of the White Star Line; dimensions, 600ft. by 75ft. by 45ft.; gross tonnage, 18,700. Engines; triple-screw machinery is fitted, comprising a four-cylinder triple-expansion reciprocating engine on each wing shaft, which exhausts into a low-pressure direct-coupled turbine on the centre, which, in turn, exhausts into two Weir regenerative condensers; constructed by the builders; launch, June 16th.

MINNIPA, single-screw motor passenger vessel; built by Burmeister and Wain, Ltd., Copenhagen; to the order of Adelaide Steamship Company, Ltd., Adelaide; dimensions, 252ft. 6in., 39ft. 6in., 24ft. 3in.; to carry cargo and passengers. Engines, one eight-cylinder four-cycle single-acting Diesel engine; constructed by Burmeister and Wain, Ltd.; trial trip recently.

No. 790 G, steel lighter; built by Harland and Wolff, Ltd., to the order of Elder, Dempster and Co., Ltd.; dimensions, 65ft. by 16ft. by 6ft.; to carry 85 tons deadweight. This lighter is designed for loading coal on the owner's vessels on the West Coast of Africa; launch, June 20th.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

MESSRS. J. C. BENTLEY AND CO., of "New Era" Works, Bertram-road, Bradford, ask us to announce that they are now the sole proprietors and makers of the Hartnell governor.

P. AND B. EVAPORATOS, Ltd., asks us to announce that it has moved its offices from 75, Victoria-street, Westminster, to St. Stephen's House, Victoria Embankment, Westminster, S.W. 1. Telephone number is Victoria 3044.

MR. D. N. DUNLOP has been appointed the British representative on the Permanent Committee on Electrical Questions set up by the Advisory and Technical Committee for Communications and Transit of the League of Nations.

FILMA OIL BURNERS, Ltd., asks us to announce that it has removed its offices from 4, Broad Street-place, to 68, Victoria-street, Westminster, London, S.W. 1. Telephone, Victoria 8648 and 8649; telegrams, "Filmaburna, Sowest, London."

THE PARSONS OIL ENGINE COMPANY, Ltd., of Town Quay Works, Southampton, asks us to announce that it has opened an office at No. 3, Victoria-street, Westminster, S.W. 1; telephone number, Victoria 2525. This office will be in charge of Mr. C. Wright.

TAITE AND CARLTON ask us to announce that as from June 20th, 1927, their address, and that of the companies, Wycliffe Foundry Company, Ltd., and Tindall Drill and Engineering Company, Ltd., with which they are associated, was changed from Sanctuary House, 33, Tothill-street, to 7, Iddesleigh House, Caxton-street, Westminster, S.W. 1.

WILLIAM ASQUITH (1920), Ltd., who have been members of the Associated British Machine Tool Makers since its inception have, we understand, now retired from that sales organisation by agreement with it. As from June 18th, 1927, Messrs. Asquith will conduct their own sales, both at home and abroad, and all inquiries should be sent to them at their offices at Halifax.

THE NATIONAL GAS ENGINE COMPANY, Ltd., of Ashton-under-Lyne, asks us to announce that it has moved into new offices and showroom in London, the address being 117, Queen Victoria-street, London, E.C. 4; telephone number, Central 7084 and 5; telegraphic address, "Forgerons, Cent, London," where it is requested that all communications to the company should now be addressed.

AT the annual general meeting of the National Federation of Iron and Steel Manufacturers, held on June 16th, Mr. Benjamin Talbot, deputy chairman and managing director of the Cargo Fleet Iron Company, the South Durham Steel and Iron Company, Ltd., and several other iron and coal companies in the North-Eastern area, was elected president for the year 1927–1928, in succession to Mr. H. C. Bond. Mr. E. J. FOX, the managing director of the Stanton Ironworks, was elected an additional vice-president.

CATALOGUES.

ALFRED HERBERT, Ltd., Coventry.—The S.K.F. ground-thread taps booklet.

HADFIELDS LTD., Sheffield.—Particulars of the "Heela" automatic tub greaser.

A. RANSOME AND CO., Ltd., Newark-on-Trent.—Catalogue S 26 on woodworking machinery.

BROOK MOTORS, Ltd., Huddersfield.—Booklet No. 158 giving the specifications of motors for mines.

GENT AND COMPANY, Ltd., Faraday Works, Leicester.—Book "T" on electro-motor syrens for all purposes.

BRITISH INSULATED CABLES, Ltd., Prescot, Lancs.—Descriptive pamphlets of the "Prescot" ceiling fan.

GOODBRAND AND CO., Ltd., Britannia Foundry, Stalybridge.—Catalogue of steel castings for fuel economisers.

WM. BOBY AND CO., Ltd., 62, Brook-street, W. 1.—Catalogue No. 125 giving particulars of lime-soda water softeners.

J. STIRK AND SONS, Ltd., Halifax.—Brochure dealing with "Stirk" planing machines, entitled "The Planer People."

H. OWEN, 133, Brudenell-road, Leeds.—Folder describing the "Owen" patented balanced double-beat regulator valve.

LANGDON ENGINEERING COMPANY (1924), Ltd., Southampton.—Folder illustrating all types of accessories for motor boats.

THE CARNEGIE STEEL COMPANY, Pittsburg, Pa., U.S.A.—Catalogue of beam sections giving the profiles and properties.

STEWARTS AND LLOYDS, Ltd., 41, Oswald-street, Glasgow.—Section S catalogue on welded and weldless main steam pipes.

UNBREAKABLE PULLEY AND MILLGEARING COMPANY, Ltd., West Girton, Manchester.—List 531 of light-weight split pulleys.

VARIABLE SPEED GEAR, Ltd., 6, Broadway, S.W. 1.—Preliminary booklet dealing with Mark III. variable delivery pumps.

COMBUSTIONS, Ltd., 31, St. Mary Axe, E.C. 3.—Catalogue dealing with "Rotamiser" oil firing equipment for furnace work.

WINGROVE AND ROGERS, Ltd., 63, Queen Victoria-street, E.C. 4.—Folder showing the firm's electric trucks and locomotives in use in Australia.

WOODALL-DUCKHAM COMPANIES, Allington House, Victoria-street, S.W. 1.—Brochure on developments in the Woodall-Duckham refuse destructor.

THE MONITOR PATENT SAFETY DEVICES, Wallsend-on-Tyne.—A reprint of an article in the *Marine Officer's Magazine*, entitled "The Safety of Forced Lubrication of Oil Engine Bearings."

THE GROSVENOR ENGINEERS, Ltd., 9, Regent's-buildings, Wakefield-street, W.C. 1.—A booklet entitled "The Soul of the Engine," giving a detailed description of the "Axella" carburettor.

THE VICTAULIC COMPANY, Ltd., King's Buildings, Dean Stanley-street, S.W. 1.—Catalogue describing fully the functioning of the Victaulic joint and the best methods of using it on water, air, gas lines, &c.

JENKINS BROTHERS, Ltd., 6, Great Queen-street, W.C. 2.—Booklet illustrating and describing in detail the various types of valves in stock; also particulars of jointings and other mechanical rubber goods.

INSTITUTION OF MINING ENGINEERS (SUMMER MEETING).—We are asked to state that the reception by the Lord Mayor and Corporation of Newcastle-upon-Tyne on the evening of Thursday, June 30th, will take the form of a reception, followed by a dance, 8.15 p.m. to midnight, at the Grand Assembly Rooms, Barras Bridge, instead of the reception at the Laing Art Gallery, as stated in the original programme, which was published in our issue of June 10th.

THE INSTITUTION OF ELECTRICAL ENGINEERS.—The ninth edition of the I.E.E. Regulations for the Electrical Equipment of Buildings has just been published. A footnote on the second page calls attention to the fact that this edition does not differ considerably from the eighth, but contains some alterations which had become urgent. The numbering of the clauses in the eighth edition has been retained as far as possible. The Wiring Regulations Committee has in contemplation the preparation of a tenth edition, which, with a view to simplification, may differ materially from the ninth in respect of arrangement and wording.

THE ATLANTIC LINER AND THE PORT OF LONDON.—We have received from the Atlantic Transport Company, Ltd., of 38, Leadenhall-street, E.C. 3, a pleasingly printed and artistically arranged art brochure of nearly seventy pages which describes the relations which have existed between the Atlantic liner and the Port of London during the last forty years. In five short chapters the origin and rise of the Atlantic Transport Line is traced and an account is given of its activities in the days before 1914, its outstanding war service and great losses, and its remarkable post-war development. We pass from the Surrey, Sussex and Suffolk, the first 3000-ton vessels chartered by the company, to the third-class tourist liner Minnekahda and the two fine first-class 21,700-ton liners Minnewaska and Minnetonka, which to-day are the largest vessels trading at the port. In a closing chapter the work of the Port of London Authority is outlined in an historical survey of the progress of the port and the development of its dock system.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
Native	18/6 to 21/–
(1) Spanish	18/6 to 21/–
(1) N. African	18/6 to 21/–
N.E. COAST—	
Native	18/– to 21/–
Foreign (c.i.f.)	22/–

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	4 2 6	
No. 1 Foundry	4 5 0	—
No. 3 Foundry	4 0 0	—
N.E. COAST—		
Hematite Mixed Nos.	3 17 0	3 17 0
No. 1	3 17 6	3 17 6
Cleveland—		
No. 1	3 12 6	3 12 6
Silicious Iron	3 12 6	3 12 6
No. 3 G.M.B.	3 10 0	3 10 0
No. 4 Foundry	3 9 0	3 9 0
No. 4 Forge	3 8 6	3 8 6
Mottled	3 8 0	3 8 0
White	3 8 0	3 8 0
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 12 6	—
,, ,, Foundry	4 1 6	—
(3) Northampton—		
Foundry No. 3	3 5 0	—
Forge	3 2 6	—
(3) Derbyshire—		
No. 3 Foundry	3 10 0 to 3 12 6	
Forge	3 7 6	—
(3) Lincolnshire—		
No. 3 Foundry	3 12 6	—
No. 4 Forge	—	—
Basic	3 12 6	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 11 6 (a) / 4 14 6 (b) / 4 18 0 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 15 0	10 10 0
Best	—	—
N.E. COAST—		
Iron Rivets	12 5 0	—
Common Bars	11 5 0	—
Best Bars	12 5 0	—
LANCS.—		
Crown Bars	11 0 0	—
Second Quality Bars	10 0 0	—
Hoops	14 0 0	—
S. YORKS.—		
Crown Bars	11 10 0	—
Best Bars	12 5 0	—
Hoops	14 0 0	—
MIDLANDS—		
Crown Bars	10 15 0 to 11 0 0	
Marked Bars (Staffs.)	13 10 0	—
Nut and Bolt Bars	10 5 0	—
Gas Tube Strip	12 0 0	—

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	11 0 0	11 0 0
Ship Plates, ½in. and up	8 2 6	7 12 6
Sections	7 12 6 to 7 15 0	7 2 6
Steel Sheets, under 3/16 in. to ½in.	10 0 0 to 12 0 0	
Sheets (Gal. Cor. 24 B.G.)	—	£15 0 0 to 16 0 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 2 6	—
Angles	7 12 6	—
Boiler Plates	12 10 0	—
Joists	7 12 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	8 12 6	—
Soft Billets	7 12 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	
Billets	8 0 0 to 11 10 0	
MANCHESTER—		
Bars (Round)	8 15 0	—
,, (Small Round)	8 2 6	—
Hoops (Baling)	11 0 0	11 0 0
,, (Soft Steel)	10 0 0	10 0 0
Plates	8 7 6	—
,, (Lancs. Boiler)	11 5 0	—
SHEFFIELD—		
Siemens Acid Billets	11 0 0	—
Hard Basic	9 2 6	—
Intermediate Basic	8 12 6	—
Soft Basic	7 0 0	—
Hoops	11 10 0	—
Soft Wire Rods	9 5 0	—
MIDLANDS—		
Small Rolled Bars	8 0 0 to 8 10 0	
Billets and Sheet Bars	6 15 0 to 7 0 0	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	14 10 0 to 14 12 6	
Angles	7 12 6	—
Joists	7 12 6	—
Tees	8 12 6	—
Bridge and Tank Plates	8 7 6	—
Boiler Plates	11 0 0 to 11 10 0	

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/9 to 19/1½
Block Tin (cash)	295 17 6
,, (three months)	285 10 0
Copper (cash)	53 15 0
,, (three months)	54 7 6
Spanish Lead (cash)	24 1 3
,, (three months)	24 7 6
Spelter (cash)	28 10 0
,, (three months)	28 8 9
MANCHESTER—	
Copper, Best Selected Ingots	58 17 6
,, Electrolytic	60 2 6
,, Strong Sheets	84 0 0
,, Tubes (Basis Price) lb.	0 1 0½
Brass Tubes (Basis Price) lb.	0 0 11½
,, Condenser lb.	0 1 1½
Lead, English	25 15 0
,, Foreign	24 10 0
Spelter	28 10 0
Aluminium (per ton)	£107

FERRO ALLOYS.

(All prices now nominal.)

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/9½ per lb.	
Ferro Tungsten	1/5 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 10 0	7/6
,, ,, 6 p.c. to 8 p.c. ,,	£22 15 0	7/3
,, ,, 8 p.c. to 10 p.c. ,,	£22 7 6	6/6
,, ,, Specially Refined		
,, ,,Max. 2 p.c. carbon	£36 5 0	11/6
,, ,, ,, 1 p.c. ,, ,,	£42 5 0	15/–
,, ,, ,, 0.70 p.c. carbon	£54 0 0	17/6
,, ,, ,, carbon free	1/5d. per lb.	
Metallic Chromium	3/3 per lb.	
Ferro Manganese (per ton)	£12 10 0 for home, £16 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 5 0 scale 5/– per unit	
,, ,, 75 p.c.	£19 5 0 scale 6/– per unit	
,, Vanadium	14/3 per lb.	
,, Molybdenum	5/– per lb.	
,, Titanium (carbon free)	0/11½ per lb.	
Nickel (per ton)	£170	
Ferro-Cobalt	9/3 per lb.	

FUELS.

SCOTLAND.

(Prices not stable.)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	14/–
,, ,, Ell	14/–
,, ,, Splint	15/3 to 17/–
,, ,, Trebles	14/9 to 15/–
,, ,, Doubles	13/3 to 13/9
,, ,, Singles	13/– to 13/3
AYRSHIRE—	
(f.o.b. Ports)—Steam	13/9
,, ,, Jewel	15/6
,, ,, Trebles	14 3 to 14/6
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	12/– to 13/6
Screened Navigation	18/– to 19/–
Trebles	15/3
Doubles	14/–
Singles	13/–
LOTHIANS—	
(f.o.b. Leith)—Best Steam	13/–
Secondary Steam	12/6
Trebles	14/9 to 15/–
Doubles	14/– to 14/3
Singles	13/– to 13/3

ENGLAND.

	Inland.
(8) N.W. COAST—	
Steams	27/6
Household	42/6 to 58/6
Coke	26/– to 27/–
NORTHUMBERLAND—	
Best Steams	14/6 to 14/9
Second Steams	13/6
Steam Smalls	10/6
Unscreened	13/– to 13/6
Household	21/– to 27/–
DURHAM—	
Best Gas	16/6 to 16/9
Second	14/3 to 14/9
Household	21/– to 27/–
Foundry Coke	23/6 to 26/6
SHEFFIELD—	
Best Hand-picked Branch	27/6 to 28/6
Best Selected House Coal	21/– to 22/6
Screened House Coal	19/– to 21/–
,, ,, Nuts	16/– to 17/6
Yorkshire Hards	16/– to 17/–
Derbyshire Hards	16/– to 17/–
Rough Slacks	10/6 to 11/6
Nutty Slacks	8/– to 9/–
Smalls	3/– to 5/6
Blast-furnace Coke (Inland)	22/– *
,, ,, (Export)	f.o.b. 17/6 to 18/–

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	21/– to 22/–
Second ,, ,,	20/– to 21/–
Best Dry Large	19/6 to 20/6
Ordinary Dry Large	18/6 to 19/–
Best Black Vein Large	19/6 to 20/6
Western Valley Large	18/6 to 19/–
Best Eastern Valley Large	18/– to 18/6
Ordinary ,, ,,	17/– to 18/–
Best Steam Smalls	14/– to 14/6
Ordinary Smalls	12/– to 13/6
Washed Nuts	18/– to 21/6
No. 3 Rhondda Large	21/– to 22/–
,, ,, Smalls	16/– to 17/–
No. 2 ,, Large	17/6 to 18/–
,, ,, Through	16/– to 16/6
,, ,, Smalls	13/– to 13/6
Foundry Coke (export)	40/– to 45/–
Furnace Coke (export)	30/– to 32/6
Patent Fuel	24/6 to 25/–
Pitwood (ex ship)	30/6 to 31/–
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	38/6 to 42/–
Seconds	30/– to 35/–
Red Vein	25/– to 30/–
Machine-made Cobbles	45/– to 47/6
Nuts	40/– to 45/–
Beans	30/– to 35/–
Peas	19/– to 21/–
Breaker Duff	8/– to 9/–
Rubbly Culm	10/– to 10/6
Steam Coals:	
Large	20/6 to 21/6
Seconds	18/6 to 20/–
Smalls	11/– to 12/–
Cargo Through	16/– to 17/–

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/– extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham. * Official quotation for pig iron producers.

French Engineering Notes.

(From our Correspondent in Paris.)

Steel Trade Depression.

In all branches of the metallurgical trades the situation appears to be getting a little worse every week, and the optimistic feeling which has prevailed all along is now giving way to one of resignation. There is little hope of anything being done until the last quarter of the year, and even then the prospect is dubious in view of the fact that the present depression is due to a general economic collapse. There are many causes which give rise to a feeling of uneasiness. There can be no element of confidence in the future until something is known of the remedies which it is proposed to apply to a very unsatisfactory situation, and for the moment they are of a conflicting and incoherent character, the main idea being to keep foreign goods out of the market and to develop a big export trade. The tariffs and commercial treaty negotiations are so inextricably mixed up that a long time will probably elapse before any adjustment or compromise can be arrived at, and until then the chances of a business recovery are very remote. Orders for iron and steel are steadily dwindling, and while French producers find their charges increase, it is affirmed that the Belgians are able to undersell them in foreign markets on account, partly, of the stabilisation of the franc at a lower rate. The greatest menace comes from Germany, where the steel production is about double that of France, and, while at present the whole of it is going into consumption at home, and is partly exported in the form of manufactured goods, there is always the possibility that German producers will be obliged eventually to look to foreign markets. Under the terms of the last agreement entered into at Luxembourg they have undertaken not to seek foreign orders until October. Meanwhile, the falling off of business is being accompanied by a slowing down of activity in all branches of the metallurgical trades. The only encouraging feature is the continued distribution of orders for railway rolling stock and other requirements, and the placing of contracts for shipbuilding material.

The Coal Trade.

The protests against the prohibition of coal imports have had the effect of eliciting from the Minister of Public Works a statement to the effect that licences will only be applied to coal for the railways and other public services. He affirms that that will be sufficient to avert unemployment at the French collieries, which is all that the Government aims at doing. The fear that the licences may bring about an advance in the prices of French coal is declared to be unjustified, in view of the measures that are being taken to ensure that wherever French coal is substituted for the foreign it must be supplied at the same price. It is difficult to see how such an undertaking can be enforced. Apart from the difficulty of compelling French owners to sell coal at foreign prices when they have declared all along that they are unable to do so, it was stated, when trouble arose in the Nord some time ago, that a strike was only averted by the Minister of Public Works promising owners to give them an opportunity to sell coal at more profitable prices as compensation for an advance in wages. As a matter of fact, the licence system is a development of the Government's coal policy which began to take form some years ago. It started soon after the Armistice when the French took umbrage at the high prices they had to pay for British coal, and then, when German reparation coal was available and supplies came from the Saar, they sought to get them substituted for British coal. The British miners' strike last year put the finishing touch to the coal policy by convincing the French that they must render themselves as independent as possible of British supplies. They firmly believe that they will be able to do that in the end. Meanwhile, the protests from importers and consumers show that this policy is not easy of execution, and the fear of retaliation from Great Britain, has had something to do with the more restricted application of the licence system.

A Novel Boat.

The well-known motor car builder, Monsieur Bugatti, is constructing a boat of entirely novel form which he hopes will travel at a speed of something like 80 miles an hour. He has, however, no exaggerated confidence in the success of his venture, but he regards it as an interesting experiment and as offering a good opportunity for testing his aviation engines. The boat has a length of 115ft. and a width of 8ft. 2in., and it has a bridge with a tall ventilation chimney which closes automatically when the water completely covers the boat to a height of 3ft. or 4ft. above the bridge. There will be eight aviation engines developing a total of 2400 horse-power. Six will drive forward and two will reverse. The idea of designing the boat is to drive it at such a speed that it will cut through the waves. In a smooth sea it will be navigated from the bridge, and if the weather is at all rough it will be awash like a submersible, ventilation being amply provided for by the chimney, which will only close automatically when driving through big waves.

Foreign Trade.

The returns of foreign trade during the first five months of the year show considerable fluctuations in quantities and values. The estimated value of imports was 22,560 million francs, a diminution of 1627 million francs, as compared with the similar period of last year. The declension was due entirely to raw material and manufactured goods. The exports were valued at 22,536 million francs, an increase of 469 million francs. As regards quantities, imports were declared at 22,150,365 tons, an increase of 2,511,475 tons, and exports 15,172,852 tons, an augmentation of 1,990,081 tons. While the imports of raw material increased by 1,752,628 tons, the value diminished by 2719 million francs. On the other hand, while the raw material exports increased by about the same amount, there was an augmentation in value of only 699 million francs. During May the imports exceeded the exports, as compared with those of April, to a far greater extent than in previous months.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

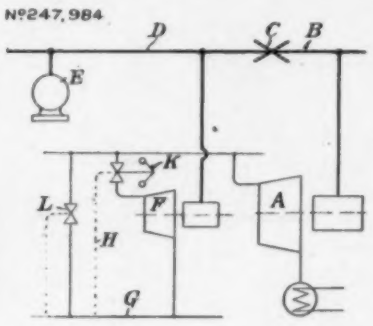
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

TURBINE MACHINERY.

247,984. February 19th, 1926.—IMPROVEMENTS IN STEAM-DRIVEN ELECTRIC GENERATING PLANTS UTILISING EXHAUST STEAM FOR AUXILIARY PURPOSES, *International General Electric Company, Inc., of* 120, *Broadway, New York, U.S.A.*

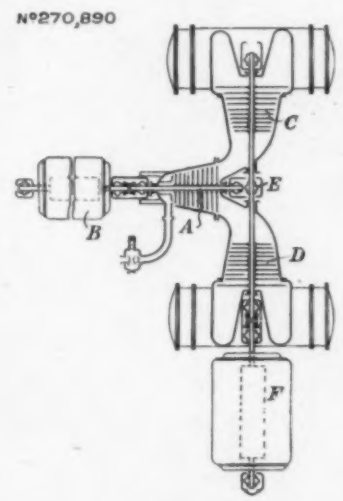
The dynamo of the main engine A feeds the main system B, which is connected by a switch device C to the house system D, which supplies the auxiliary drives E with current. The back-pressure engine F is loaded in accordance with the requirements of the steam-consuming units connected with the main G by a pressure regulator H, which controls the steam admission to



engine according to the pressure in the main G. The back-pressure engine then feeds the excess of current, which the auxiliary drives E do not require, into the main system B. In the event of a disturbance in the main system B, the switch device C is opened. The back-pressure turbine F then supplies the consuming units E exclusively. At the same time, the pressure regulator H which has hitherto controlled the loading of the engine, is put out of action by the speed governor K. The deficient heating steam is then supplied by the throttle valve L, which is automatically operated in response to the pressure in the main G.—*May 19th, 1927.*

270,890. April 27th, 1926.—IMPROVEMENTS IN AND RELATING TO ELASTIC FLUID TURBINES, The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2, and Robert Hugh Collingham, of 81, Hillmorton-road, Rugby.

The high-pressure rotor A is connected to an alternator B, and the steam from the high-pressure rotor passes into two low-pres-

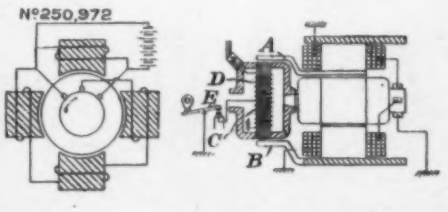


sure turbines C and D mounted on shaft E, which is coupled to an alternator F. The high-pressure turbine may rotate at 3000 revolutions per minute, and drive a two-pole alternator generating 50-cycle current, whilst the low-pressure turbines C and D may run at 1500 revolutions per minute and drive a four-pole alternator, which will, of course, also generate 50-cycle current.—*May 19th, 1927.*

DYNAMOS AND MOTORS.

250,972. April 17th, 1926.—IMPROVEMENTS IN OR RELATING TO DYNAMO-ELECTRIC GENERATORS, Fritz Kesselring, of 94, Landgrabenstrasse, Nurnberg, Germany.

The dynamo described in this specification is intended mainly



for motor cars, and it has a combined lighting and ignition armature. One of the pole shoes of the lighting generator is extended as shown at A, and the yoke of the machine is also extended as shown at B, and between these extensions an ignition armature carrying primary and secondary windings C and D revolves. The contact breaker is indicated at E. The diagram on the left shows the connections for the lighting part of the machine.—*May 19th, 1927.*

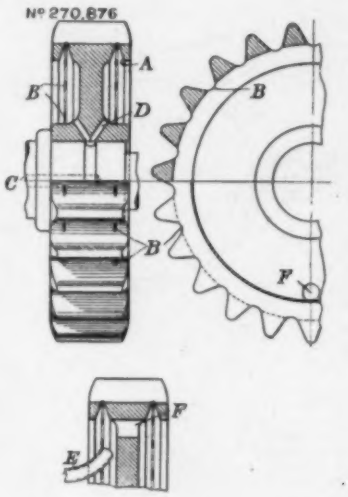
TRANSMISSION OF POWER.

253,496. May 11th, 1926.—IMPROVEMENTS IN ARMOURING FOR SINGLE-CORE ALTERNATING-CURRENT CABLES, Felten and Guilleaume Carlswerk, Actiengesellschaft, of Köln-Mülheim, Germany.

This invention is based on the fact that when cable armouring is subdivided into individual longitudinal sections insulated from one another, the part voltages induced therein are reduced by dividing the armouring into short sections. If the sections are sufficiently short, the part voltages induced therein remain below the limit at which the currents penetrating from the armouring and through the winding of jute into the earth could cause disturbances. The invention consists in providing the armouring of single-core alternating-current cables with a short interruption at one or several points of each length of cable, whereby the induced currents in the armouring are practically avoided. The cable, which comprises a central conductor surrounded by an insulating layer and a lead sheathing around the insulating layer, is provided around the lead sheathing with the usual steel wire armouring, an insulating or cushioning layer being interposed between the lead sheathing and the outer armouring. The armouring is interrupted at one or more places of each length of manufactured cable, and the interruption is surrounded by a layer of filling substance, over which a cable protecting sleeve is placed.—*May 19th, 1927.*

270,876. April 6th, 1926.—IMPROVEMENTS IN THE LUBRICATION OF TRANSMISSION GEARING, John Weller, of "Amberley," Lower-road, Great Bookham, Surrey.

The object of this invention is to provide a direct supply of fluid lubricant to the individual teeth in a spur or chain wheel. Annular V-shaped grooves A are formed within the wheel, and

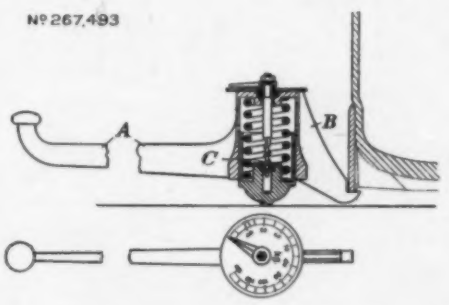


oil is impelled by centrifugal force through small slots B. From an oil way C drilled in the shaft oil passes through holes D and supplies the annular grooves A. Alternatively, oil pipes E may direct a jet of oil on to the annular grooves as shown in the lower illustration, F being a communicating hole by which the oil passes from one side to the other when there is more than one annular groove.—*May 19th, 1927.*

MEASURING AND TESTING INSTRUMENTS.

267,493. March 1st.—A SPRING BALANCE, Daniel Siebenmann, of 4–4A, Konsumstrasse, Berne, Switzerland.

The spring balance described in this specification consists of a lever with arms A and B of unequal length, and adapted for lifting a load in the manner shown. At the fulcrum there is a



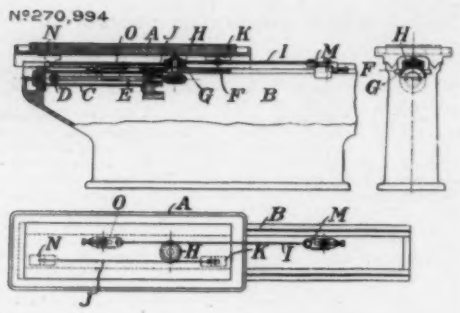
supporting member which is free to move against the action of a spring, and this movable member is connected to a mechanism which indicates the weight of the load. The position of the indicating mechanism is governed by a thread C working in a nut.—*May 19th, 1927.*

MACHINE TOOLS AND SHOP APPLIANCES.

270,994. December 29th, 1926.—IMPROVEMENTS RELATING TO SURFACE GRINDING MACHINES, The Churchill Machine Tool Company, Ltd., of Broadheath, Altrincham, Chester, and Harry Hales Asbridge, of Claremont, Washway-road, Ashton-on-Mersey.

This invention relates to surface grinding machines of the type in which a long relative traverse of the grinding wheel and workpiece is necessary. The object of the invention is to provide improved means for effecting the desired traverse of the slide, table or other arrangement carrying the grinding wheel or the work-piece. A indicates the table or slide to be traversed upon the bed B of the machine. A double-acting hydraulic cylinder C is mounted in the bed, and has a plunger D connected by a piston-rod E to a slide F, which runs in guides in the bed, as

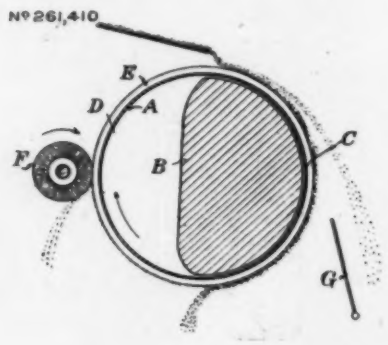
shown in the lower illustration. The slide carries a vertical spindle with two rope pulleys G H. There are two rope connections I J, which pass round the pulleys. The rope I is secured at one end to a bracket K fixed to the underside of the table,



and at the other end to an adjustable bracket M on the machine bed. The rope J is secured to the bracket N on the machine table and to the adjustable bracket O on the bed.—*May 19th*, 1927.

261,410. November 13th, 1926.—IMPROVEMENTS IN OR RELATING TO MAGNETIC SEPARATORS, Fried. Krupp Grusonwerk Aktiengesellschaft, of Magdeburg-Buckau, Germany.

Within a revolving drum A there is a stationary magnet B, with semi-circular poles; consequently, at the point C there is a magnetic zone and at the point D a non-magnetic zone. The

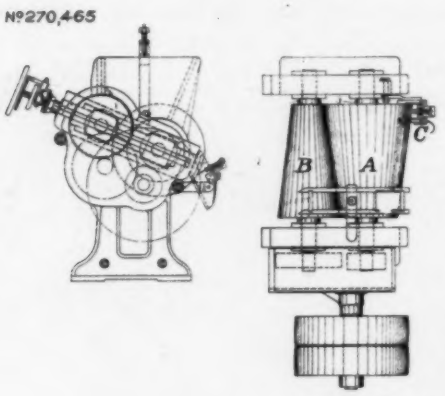


drum is provided with the usual iron rings E, and in the non-magnetic zone the rings make contact with a revolving iron wire brush F. The material to be treated is mixed with a considerable amount of water, and the non-magnetic material is thrown off and falls beyond the partition G, whilst the bulk of magnetic material is carried on and falls under the drum, any material remaining on the drum being removed by the brush F, which makes light contact with the drum.—*May 19th*, 1927.

CRUSHING AND GRINDING.

270,465. March 25th, 1926.—PAINT GRINDING MILLS, J. R. Torrance, Bitton, Glos.

In this twin-roller paint mill the two rolls are tapered, as shown in the plan view, but are of similar diameters at the feed

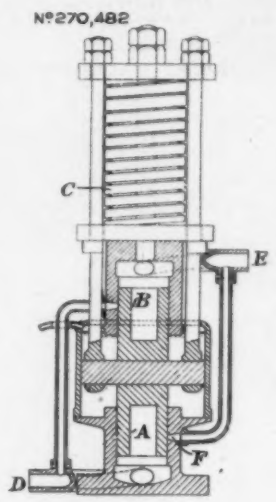


end. The faster-running roll A takes the paint from the slower roll B and at the same time feeds it forward to the other end, where it is scraped off by the doctor knife C.—*May 12th*, 1927.

SHIPS AND BOATS.

270,482. April 26th, 1926.—HYDRAULIC STEERING GEAR, H. S. Hele-Shaw and T. E. Beacham, 64, Victoria-street, Westminster.

This invention is concerned with a safety valve device for hydraulic steering gear, which will enable the rudder to give way under wave shock at any predetermined pressure, but yet will not prevent the pressure necessary to put the rudder hard over being attained. It comprises a double-ended ram A B loaded

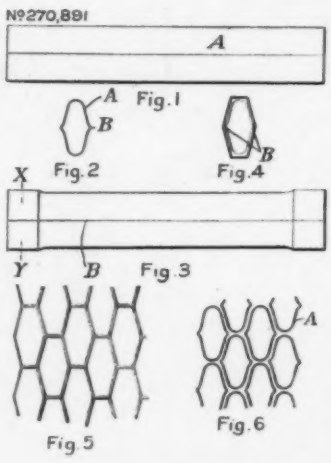


by means of a spring C and in communication with the tiller rams by the passages D and E. In the event of the rudder receiving a blow which increases the pressure in the system connected with D, the double-ended ram will rise and relieve the blow to some extent. If the blow is severe the port F will be uncovered and the system will be put in equilibrium. The same action takes place at the opposite end of the ram.—*May 12th*, 1927.

MOTOR CARS AND ROAD TRAFFIC.

270,891. April 27th, 1926.—IMPROVEMENTS RELATING TO TUBES FOR HEAT EXCHANGERS, Serck Radiators, Ltd., and Oscar Serck, both of Warwick-road, Greet, Birmingham.

This invention relates to heat exchangers such as aircraft radiators, oil coolers, &c., in which tubular elements are employed, and the object is to obviate the risk of fracture when expanding the ends of the tubes, thus avoiding the necessity for annealing. The invention also enables very thin tubes to be used. The parallel tubes A are elliptical or approximately elliptical in shape, and along each side of the tube a ridge or corrugation B is formed. The ends of the tubes are expanded to an elongated hexagonal form, and in this operation there is little or no stretch-



ing of the material, as the perimeter of the hexagonal portion is made equal to that of the elliptical portion, and the corrugations, the latter affording the extra material necessary to permit the required changes of cross section without stretching. If, however, any stretching should occur, it is small as compared with that usually experienced. Fig. 1 is a side elevation and Fig. 2 a cross section of a radiator tube. Fig. 3 a side elevation of a finished tube with expanded ends, and Fig. 4 a cross section on the line X Y, Fig. 3. An elevation showing the ends of a portion of a group of tubes is shown in Fig. 5; whilst Fig. 6 is a cross section showing the intermediate portion of the tubes.—*May 19th*, 1927.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—The Council Offices, Barton-on-Humber. East Midland District meeting. 11 a.m.

TUESDAY, JUNE 28TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Visit to the Kent Cement Works at Greenhithe by steamer, which will start from Westminster Bridge Pier at 10 a.m.

WEDNESDAY TO FRIDAY, JUNE 29TH TO JULY 1ST.

INSTITUTION OF MINING ENGINEERS.—Summer meeting at Newcastle-on-Tyne. For Programme see page 638.

SATURDAY, JULY 2ND.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH.—Visit to the Castleton Works of Messrs. Tweedale and Smalley.

THE INSTITUTION OF CIVIL ENGINEERS: YORKSHIRE ASSOCIATION.—Visit to the Sladen Valley waterworks of the Keighley Corporation. The party will assemble at the works at 3.30 p.m.

THE INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—The Town Hall, St. Annes-on-Sea. North[illegible]n District meeting. 10.30 a.m.

SATURDAY TO MONDAY, JULY 2ND TO 4TH.

NATIONAL INDUSTRIAL ALLIANCE.—Week-end Conference at the House of Retreat, Pleshey, Chelmsford.

SATURDAY, JULY 16TH.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Coun[illegible] Chamber, Guildhall, Cambridge. Eastern District meetin[illegible] 2 p.m.

CONTRACTS.

THE OGDEN ENGINEERING COMPANY, of 2, Blue Boar-court, Market-place, Manchester, has received an order for the complete air-washing, heating and ventilating plant for the Masonic Temple, Bradford, Yorkshire, which will be a six-storey building.

THE GENERAL ELECTRIC COMPANY, Ltd., of Magnet House, Kingsway, W.C. 2, has recently secured a further order from the Manchester Corporation Tramways for fifty type W.T.31.K motors, rated at 50 B.H.P. on the one-hour rating, 500 volts. This is the fifth successive order received by the company from the Manchester Corporation Tramways for tramway motors.

WORTHINGTON-SIMPSON, Ltd., of Queen's House, Kingsway, W.C. 2, have received from the Reading Waterworks an order for one 9in. single-stage high-lift centrifugal pump, to be capable of delivering 2,000,000 gallons of water per twenty-four hours against a head of 170ft. The pump is to run at a speed of 1500 r.p.m. and will be driven by a 140 B.H.P. Crompton protected-type auto-synchronous motor. This pump is a duplicate of a set previously supplied to the same station.

JOHN THOMPSON WATER TUBE BOILERS, Ltd., of Wolverhampton and Imperial House, Kingsway, London, W.C. 2, Eng., informs us that it has received an order from the Tata Iron and Steel Company, Ltd., of Jamshedpur, India, for ten of its "John Thompson" vertical straight-tube "Alpha" type water-tube boilers, each having 10,660 square feet of heating surface, working pressure of 225 lb. per square inch, together with superheaters, air heaters, steam receivers, and forced draught equipment. These boilers are to be fired by blast-furnace gas.

THE METROPOLITAN-VICKERS ELECTRICAL COMPANY, Ltd., has received an order covering the main switchgear and a considerable amount of auxiliary apparatus for extensions to the Portobello power station of the Edinburgh Corporation. The equipment includes a nine-panel extension to the existing main 6600-volt switchgear, a thirteen-panel 400-volt station service board and four fifteen-panel switchboards for the boiler-house, together with a 230-volt power station battery and extensions to the station telegraph system. An interesting and novel feature of the arrangement is that not only the circuit breakers, but also the bus-bar selector switches and the feeder isolating switches will be electrically operated.

GREAT WESTERN RAILWAY officially announces that the following contracts have been placed:—(*a*) Supply of nine one-ton standard Ford trucks, one standard truck body, and nine one-ton standard Ford vans, R. Pratt, Ltd., High-street, Sutton, Surrey; (*b*) overhaul of ss. Great Western, Cardiff Channel Dry Docks Company, Ltd., Cardiff; (*c*) overhaul of ss. St. Andrew, Cardiff Channel Dry Docks Company, Ltd., Cardiff; (*d*) renewal of West Outer Roundhead, Swansea Docks, Mr. George Palmer, Neath; (*e*) erection of new warehouse at Brentford Dock, A. Jackaman and Son, Ltd., Mackenzie-street, Slough; (*f*) paving platforms, Newton goods shed, Cardiff, Western Trinidad Lake Asphalte Company, Ltd., St. Mary-street, Cardiff; and (*g*) excavation in connection with the provision of a siding at Wootton Bassett, Mr. Henry Smith, 55, Fields-road, Newport, Mon.

END OF VOL. CXLIII.

AUCTIONS

DOUGLAS & GRANT, Ltd. (in Liquidation).
DUNNIKIER FOUNDRY AND ENGINEERING WORKS, KIRKCALDY.

IMPORTANT EXTENSIVE SALE OF HIGH-CLASS MODERN ENGINEERING, FOUNDRY, SHEET METAL, WOOD-WORKING AND SMITHY PLANT, MACHINERY, STOCK, OFFICE FURNITURE, ETC.
including

7 Electrically Driven Overhead Travelling Cranes, 25, 20, and 5 tons.
4 All-steel Electrically Driven Foundry Jib Cranes.
Electrically Driven High-speed Planing Machine, by John Stirk and Sons, Ltd., take in 5ft. by 5ft. by 16ft.
28 Surfacing, Screw Cutting, Turret and Capstan Lathes, from 7½in. to 16½in. centres, all by eminent makers.
No. 2 Pearns-Richards High-speed Surfacing, Boring, Drilling and Milling Machine.
High-speed Boring, Drilling and Milling Machine by Richards.
72in. and 60in. Belt-driven Boring and Turning Mills, by Richards and John Stirk and Sons, Ltd.
30/33in. stroke High-speed Belt-driven Slotting Machine, by Thomas Shanks and Co., Ltd., Johnstone (new 2 years ago).
Asquith Improved High-speed Central Thrust Radial Drilling, Boring, Tapping and Studding Machine, 7ft. radius.
Asquith and Archdale High-speed Radial Drilling, Tapping and Studding Machines, 4ft. radius.
Massive Belt-driven Vertical Planing Machine or Wall Creeper, by Loudon Bros.
Heavy Fly-wheel Boring and Turning Machine, take in up to 30ft. dia. by 7ft. wide.
Horizontal Cylinder Boring Machine.
Also
TOOL-ROOM EQUIPMENT.—Herbert Universal Grinder, Parkson Universal Milling Machine, Brown and Sharpe Plain Milling Machine, 16in. and 12in. Shaping Machines, Slotting Machines, Heavy and Light Drilling Machines, Keyseating and Keyway Cutting Machines, Tool Grinders, &c.
SHEET METAL AND SMITHY PLANT AND MACHINERY.—5-cwt. "Massey" Pneumatic Hammer, 2 "Blacker" Power Hammers, Heavy and Light Bending Rolls, Punching and Shearing Machines, Guillo[illegible]
Woodworking [illegible] and Machinery.
18 Electric Motors, from 112 to 2 H.P., 460 volts D.C.
New 150 B.H.P. A.C. Three-phase Slip-ring Motor, volts 380, cycles 50.
75 K.W. D.C. Electric Generating Set, 2 D.C. Dynamos.
10in. Saddle-tank Locomotive, by Barclay, Kilmarnock, 4' 8½" gauge.
[illegible] New Horizontal Driving Engines, by Douglas [illegible]ant, Ltd., from 14 to 43 H.P.
[illegible] B.H.P. Horizontal Tandem Compound Con[illegible]ng Driving Engine.
[illegible]gersoll-Rand "Imperial" Type XCB Power-[illegible] Two-stage Air Compressor, with Receiver and [illegible]sections.
[illegible]ouble-flued Lancashire Steam Boiler, 28ft. by 6in., insured at 120 lb.
[illegible]vaporative Condenser Green's Economiser, Super[illegible]ater.
2 Cupolas, 8 and 5 tons; Foundry Ladles from 10 tons.
About 200 Tons C.I. Moulding Boxes.
About 300 Tons C.I., M.I., and Steel Scrap; [illegible]out 15 Tons Scrap Brass, Copper, Spelter, &c.
Large Number Wooden Patterns and Jigs.
About 3000 Cubic Feet Seasoned Beech Planking.
Large and Varied Assortment of Stores, Steel Plates, Bolts and Nuts.
Office Furniture, Comptometers, Dictaphones, Safes, &c. At
DUNNIKIER FOUNDRY, KIRKCALDY, ON MONDAY 4th, TUESDAY 5th, WEDNESDAY 6th, THURSDAY 7th, and FRIDAY 8th JULY, 1927,
Beginning each day at ten o'clock prompt.

Shirlaw, Allan and Co.,
Auctioneers, Hamilton, have received instructions from A. W. Robertson Durham, Esq., C.A., F.F.A., 33, Charlotte-square, Edinburgh, Liquidator of this Company, to SELL by AUCTION as above.
On view Wednesday, Thursday, Friday and Saturday prior to Sale or earlier by arrangement with Auctioneers.
Catalogues from AUCTIONEERS,
Hamilton, June, 1927. 5752 x

FOR SALE
Continued from page 2

COCHRAN VERTICAL BOILER, 1916, 100 lb. w.p., 14ft. by 7ft. DITTO, 17ft. by 7ft., 1919, 100 lb. w.p., waste heat type. LANCASHIRE BOILER, by Tinker, Shenton, 24ft. by 7ft., 125 lb. w.p.—HARRY H. GARDAM and CO., Limited, Staines. 'Phone 98. 5799 o

FOR SALE.

5-TON DOUBLE PURCHASE STEAM-DRIVEN WINCH, by Sheppard, of Bridgend, steam cyls. 8in. dia., 10in. stroke, 36in. dia. drum by 24in. wide.
48in. dia. STEAM-DRIVEN HYDRO-EXTRACTORS, makers, Potts, Cassels, suspended type, with steel perforated cage or basket.
Modern 12½in. Centre LATHE, by Milwaukee, with straight "V" bed, 12ft. long, S.A., S.S and S.C. gear-box change, &c
6in. CENTRIFUGAL PUMP, by Gwynnes, direct electric motor driven, for 460 volts D.C., complete.
4in. DITTO, for 440 volts, all complete.
MASSIVE SET of HORIZONTAL BELT-DRIVEN GEARED TWO-THROW PUMPS, by Lee, Howl; pistons 6in. by 12in. stroke, 20,000 g.p.h. at 75 strokes per minute.
LARGE HORIZONTAL SET BELT-DRIVEN GEARED THREE-THROW RAM PUMPS, by Campbells; rams 8in. by 12in stroke, cap. 13,000 g.p.h. to 600ft. series.
VERTICAL STEAM-DRIVEN DOUBLE RAM PUMPS, all cast iron valves, cyls. 8in. by 16in., rams 6in. by 8in., C.I., 7000 g.p.h.; also DITTO cyls. 6in. by 8in., all cast iron valves and rams, 4in. by 6in. stroke, cap. 3000 g.p.h.
VERTICAL BELT-DRIVEN DOUBLE RAM PUMPS, all cast iron fitted, rams 6in. dia. by 8in. stroke; and DITTO, 4in. by 6in. stroke.
200 K.W. GENERATOR, by Cromptons, shunt wound, interpole, 220 volts D.C., 910 amps., cont. rating, speed 1200 r.p.m.
TWO 120 K.W. GENERATORS, by Electromotors, shunt wound, interpole, cont. rating, 230 volts D.C., 443 amps., 1200 revs.
GOOD RACK-DRIVEN PLANING MACHINE, table 7ft. 6in. overall by 2ft. 9½in. wide, running on "V" bed, admit between pillars 3ft. 6in., thoroughly overhauled.
FURTHER PARTICULARS ON APPLICATION. SEND FOR LISTS.
STANLEY ENGINEERING CO. Bath. Ex.

FOR SALE.—
1 Marine Type CYLINDRICAL BOILER, 13ft. dia. by 11ft. long, 3in. tubes, 1800 sq. ft. heating surface, 220 lb. w.p., 2 furnaces, complete with steam mountings.
2 Brush-Ljungstrom TURBO-ALTERNATORS, each of 625 K.W. capacity, 3600 r.p.m., 650 volts, 60 cycles, suitable for 180 lb. per sq. in. steam pressure, complete with underslung condensers each of 1150 sq. ft. cooling surface, generators fitted with self-contained exciters, lubricating oil fittings and usual equipment.
2 Induction 3-phase, 650-volt MOTORS, each of 785 B.H.P., 714 r.p.m., built by Brush Electrical Engineering Co., Loughborough.
1 HELICAL REDUCTION GEAR, comprising one wheel and two pinions, capable of transmitting 1570 B.H.P., total with reduction ratio of 714, 76 r.p.m., complete with casing and usual fittings, gearing manufactured by Power Plant Company.
Above plant, together with miscellaneous starters, pumps, &c., removed from ss. Wulsty Castle, can be inspected at Naval Construction Works, Dalmuir, and offers for same should be sent to Messrs. WILLIAM BEARDMORE and CO., Limited, Engine Department, Dalmuir. 5719 o

THE COSMOPOLITAN STEAM TRAP

Positive discharge
No air lock
Complete absence of complications
For pressures up to 350 lbs
For superheat

Renewable valve and seat in special non-corrodible steel
Main discharge tube of solid drawn steel
Non-corrodible open type bucket in galvanised steel

HOLDEN & BROOKE Ltd Sirius Works West Gorton MANCHESTER

GREY IRON CASTINGS
CHEMICAL PLANT.
CONDENSER COILS.
WATER TANKS.
FOUNDRY IN LONDON.
REPETITION CASTINGS at Specially Cheap Rates.
The Chemical Engineering and Wilton's Patent Furnace Co., Ltd.,
76, VICTORIA ST., S.W.1.
Telephone: Victoria 2417.

For continuation of For Sale Advertisements see page 4.

ALFRED HERBERT LTD.,
Telephone: 5061 (3 lines). COVENTRY. Telegrams: Lathe, Coventry.

RE-CONDITIONED MACHINE TOOLS.

The following, selected from our stock of 1500 Machine Tools, have been re-conditioned in our works and are fully covered by **our guarantee.** Practically equal to new in every respect, they afford a splendid opportunity to instal first-class equipment economically.

Hendey 10" × 10' Straight Bed Lathe	£285	Alfred Herbert No. 3, 24" × 36" Hexagon Turret Lathe	£395
Reinecker No. 2 (Bilgram Type) Bevel Gear Cutter	£150	Lodge & Shipley 8" × 10' Straight Bed Lathe	£145
Alfred Herbert 12" × 30" Universal Grinder	£270	Gridley 3" 4-spindle Automatic Screw Machine	£275
Dreses 5' Plain Radial Drill	£315	Boye & Emmes 9" × 8' Straight Bed Lathe	£135
Norton 14" × 72" Plain Grinder	£515	Colburn D 3 24" Heavy Duty Upright Drill	£250
Lumsden No. 12 16" Plain Cup Wheel Wet Tool Grinder	£40	Churchill No. 2 Cylinder Grinder	£325

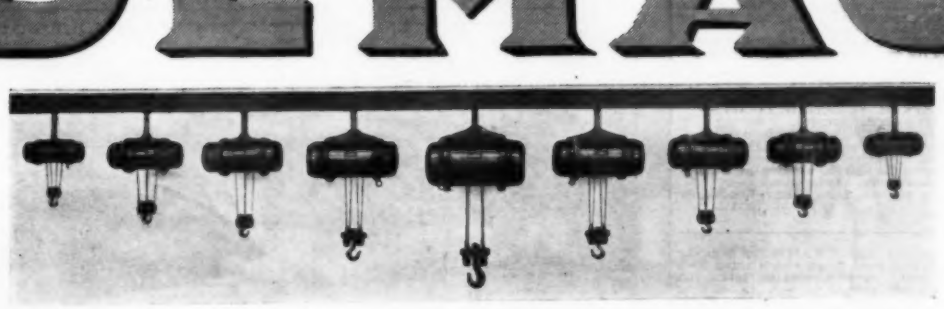
(OFFERED SUBJECT TO PRIOR SALE.)

Write for a copy of our latest Machine Tool Clearance List.

BORING AND DRILLING PLANTS
(ROCK AND EARTH).
Any Depth Any Strata.
PLANTS in use from 2in. to 8ft. 6in. DIAMETER
A. C. POTTER & CO.,
ENGINEERS,
GRANTHAM.
Tel.: 311 Grantham. Teleg.: "Pumps," Grantham

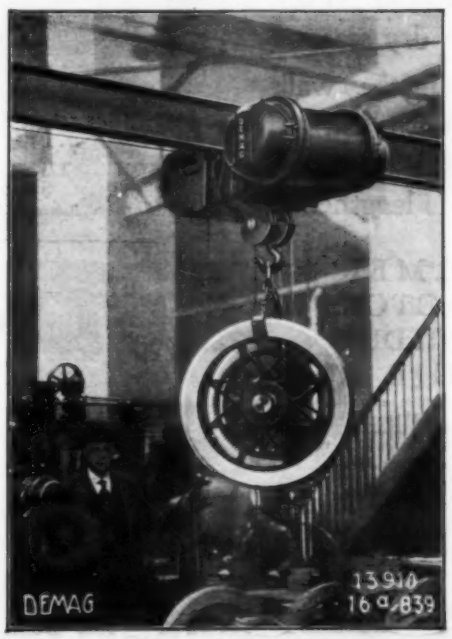
GAYWOODS BRONZE CO.,
6, Elgin Road, Seven Kings, ILFORD.
PHOSPHOR BRONZE INGOTS, CHILLS, CASTINGS
S.E.R. BRAND.
For Bearings, Mill Brasses, Worms and Worm Wheel Blanks
Wire: "Alloys, Ilford."
Telephone: Ilford 1882.
WHITE ANTIFRICTION METALS.

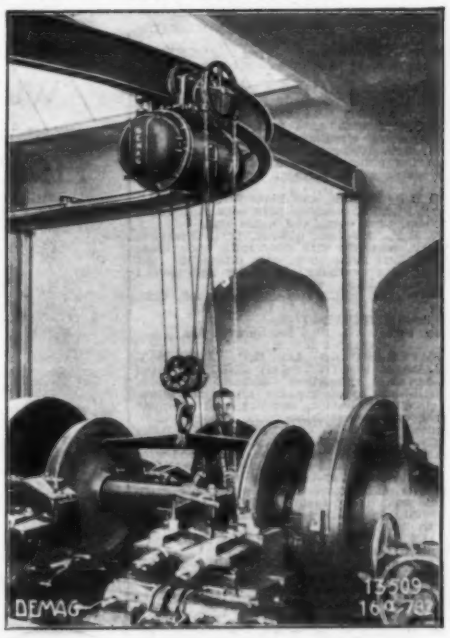
DEMAG



Electric Pulley Blocks

Complete with Suspension Eye, Hand or Electric Travelling Gears.
Unsurpassed in Economical Efficiency.
Thousands of these Lifting Devices,
¼ to 5 Tons Carrying Capacity,
are employed in works of all kinds and have stood all tests satisfactorily.
KEPT IN STOCK AT LIVERPOOL.





Agents: Aabacas Engineering Co., Ltd., 10, Canning Place, Liverpool.
Telephone: 4339 CENTRAL. Telegrams: "AABACAS," LIVERPOOL.

FOR SALE
continued from page 3.

FOR SALE.

FOUR SPECIAL GAUGE PORTABLE DERRICKING STEAM LOCO. TRAVELLING CRANES (Dock type).
One 10-ton capacity; One 12-ton capacity; Two 5-ton capacity.
Each two engines, 8in. cyl. by 12in. stroke; boilers, each 80 lb. pressure.
Makers, G. Russell and Co., Ltd., Motherwell.
Apply, JOHN JACKSON and CO., Ltd., Balmoral Works, Scotstoun, Glasgow. 5690 G

FOR SALE, Nearly New 10-Ton ELECTRIC OVERHEAD TRAVELLING CRANE, 3-motor type, 480 volts D.C., 50ft. span. Can be seen working.—Address, 5794, The Engineer Office. 5794 G

HEAVY VERTICAL LOG BAND MILL, by Allis-Chalmers, pulleys 72in. dia., for saws up to 10in. wide; log carriage of all-steel construction, 30ft. long; 5 head blocks; 40in. knee opening; double-acting Knight type dogs; Trout setworks; heavy gear of friction type by wire ropes. Cost over £4000; only done one month's work. In perfect order. Price £1000. May be inspected at our works.—JOHN PICKLES and SON (ENGINEERS), Ltd., Hebden Bridge. 5750 G

MACHINERY, PLANT, &c.

THREE 16in. BLANCHARD VERTICAL SURFACE GRINDING MACHINES, with 26in. magnetic chuck.
Nearly New PLAIN CYLINDRICAL GRINDING MACHINE, by Loewe, grinding diameter 21¼in., length 13ft. 1in.
No. H 4 BIERNATZKI HORIZONTAL HIGH-POWER MILLER, w.s. of table 65in. by 16¼in., with dividing heads.
"UNION" HORIZONTAL BORING MACHINE, single pulley drive, movable standard, fixed table 7ft. 3in. by 6ft. 6in., spindle 3¼in. diam.
40ft. PILING FRAME, with 7in. by 9in. "SYKES" STEAM PILING WINCH and VERTICAL BOILER.
FOUR "Tangyes" 40-ton (tested to 50 tons) HYDRAULIC JACKS, each with handle and key.
SEVERAL high-class nearly new SCOTCH MARINE BOILERS, 10ft. 9in. long by 13ft. 3in. diam., for 125/135 lb. working pressure; in first-class condition and complete with fittings; ready for immediate delivery.
Nearly New LANCASHIRE BOILER, 30ft. by 9ft., reinsurable at 100 lb. working pressure, complete with steam and furnace fittings, &c.
Large stock of very good second-hand FLAT-ENDED CIRCULAR BOILER STORAGE TANKS.
CATALOGUE (10,000 Lots) ON APPLICATION.

THOS. W. WARD LTD.,
ALBION WORKS, SHEFFIELD.

MARSHALL Class "L.H." Drop Valve Condensing STEAM ENGINE, cyls. 14¼in. and 26in. by 36in. stroke, rope fly-wheel.
Also similar ENGINE, by Robey, Class "E," mammoth beds, cyls. 19in. and 30in. by 36in. stroke.
DITTO, Non-condensing, cyls. 16in. and 28in. by 30in. stroke, with extended crank shaft.
HARRY H. GARDAM and CO., Limited, Staines. 'Phone 98. Send for our latest catalogue. 5798 G

MODERN STEAM SHUNTING LOCOS:—12in. six wheels coupled "Barclay" Loco., new 1918; 14in. six wheels coupled "Kerr-Stuart" Loco., new 1917; 14in. four wheels coupled "Barclay" Loco., new 1915. All above insured for 160 lb. working pressure and in first-class order. Low prices.
R. H. NEAL and CO., Ltd., Ealing, London, W. 5. 5731 G

NEW C.S.C. MARINE ENGINE, 11in. by 24in. by 16in. stroke, Lockwood rings, piston valve, &c., H.P. and L.P. fitted metallic packing thrust on crank shaft, bracket bolted to bed to end of coupling, built and passed by Lloyd's. F.o.r. £650. Ready for dispatch; inspection at makers.
These engines have given every satisfaction.
WILLIAM BURRELL, Marine Engineer, Great Yarmouth. P3336 G

THREE 75 K.W. 415/440 volt 3-Phase 50 Periods STEAM ELECTRIC GENERATING SETS for Disposal, with Berry Transformers to 550 volts; can be seen running.—HARRY H. GARDAM and Co., Ltd., Staines. 'Phone 98. 5626 G

TWO LIGHT RAILWAY AND GENERAL ENGINEERS.—OFFERS WANTED for STOCKS of LIGHT RAILWAY MATERIAL and PLANT, suitable for the manufacture of same. Dealers' offers will not be entertained.—For further particulars write to Z.P. 525, care Deacon's, 9, Fenchurch-avenue, E.C. 3. 5767 G

TWO Horizontal Duplex Steam-driven HYDRAULIC PUMPS, by Rice, 12in. by 2¼in. by 16in. and 12in. by 3¼in. by 16in., practically new.
HARRY H. GARDAM and CO., Limited, Staines. 'Phone 98. Send for our latest catalogue. 5801 G

Unique Offer of LIGHTING & POWER PLANT

ALL IN FIRST-CLASS CONDITION AND READY FOR IMMEDIATE SERVICE.
The PLANT consists of the following MACHINERY, which has only recently been taken out of commission.
PLANT No. 1.
ONE WATER-COOLED 125 H.P. Fielding and Platt SUCTION GAS ENGINE, fitted with graduated governor, water-cooled exhaust valve, magneto ignition, complete with gas cocks, exhaust pipes, air pipes, silencers, circulating pump, gas bag for town's gas, three 1000-gall. circular cooling tanks, one 5ft. driving pulley and complete set of spares, comprising piston rings, springs, valves, cam shaft, gears, &c.
ONE 100 H.P. Fielding and Platt SUCTION GAS GOVERNOR PLANT, complete with coke and wood-wool scrubbers, pipe work, and water seal.
ONE 100 H.P., 460-Volt, 540-rev. D.C. Crompton GENERATOR, complete with slide rails, open type, shunt wound, four main poles, four interpoles. Oil ring bearings with overhung pulley for belt drive; diameter of pulley 20in.; width 20in.
MAIN DRIVING BELT for the above set, 60ft. by 1ft. 6in.
ONE Wells OIL SEPARATOR.
ONE 10in. belt-driven FAN for blowing fire.
PLANT No. 2.
ONE WATER-COOLED 230 H.P. NATIONAL TWIN-CYLINDER SUCTION GAS ENGINE, fitted with hit-and-miss governor, magneto ignition, complete with gas cocks, exhaust pipes, air pipes, silencers, circulating pumps, gas bag, and complete set of spares, comprising piston rings, valves, &c.
ONE Smith's Patent WATER COOLER.
ONE 200 H.P. Dowson and Mason SUCTION GAS PLANT, complete with coke and wood-wool scrubbers, pipe work and water seal.
ONE 134-kilowatt, 460-Volt, 450 rev. Crompton GENERATING SET, complete with slide rails, open type, shunt wound, six main poles, six interpoles, with three oil ring bearings; diameter of pulley 33in., width 26in.
ONE MAIN DRIVING BELT, 65ft. by 20in.
ONE Wells OIL SEPARATOR.
ONE Sturtevant Belt-driven BLOWER.
ADDITIONAL PLANT.
ONE 4in. Kennedy WATER METER.
TWO Herbert Morris 5-Ton LIFTING BLOCKS.
TWO 36in. Belt-driven EXHAUST FANS.
ONE TUBULAR STEAM BOILER, approx. 9ft. long by 4ft. diameter, by the National Gas Engine Co.
THREE OIL TANKS.
The WHOLE PLANT is being OFFERED for SALE by PRIVATE TREATY at very reasonable prices. It is situated a short distance out of London, and can be viewed at any time by appointment.—In the first instance, address 5761, The Engineer Office. 5761 G

FOR SALE

SPECIAL BARGAINS.

SIX Foster 14in. CAPSTAN LATHES.
SIX 8tepdos PLAIN MILLING MACHINES, working surface 2ft. 2in. by 8in.
ONE No. 6 Cochran-Bly COLD SAW, 8in. capacity.
ONE "Fellowes" No. 6 GEAR SHAPER.
14in. centre "Broadbent" BRAKE LATHE, S.S. and S.C., admits 48in. by 36in. in gap, 12ft. 6in. slotted bed with front extension, 4ft. 5in. by 2ft. 7in.
"Churchill" 6in. by 34in. PLAIN GRINDER, No. 0 drive.
"Cincinnati" UNIVERSAL TOOL and CUTTER GRINDER, No. 1½.
18in. Ormerod SHAPING MACHINE, with or without motor drive.
ONE "Cleveland" Model "A" FULL AUTOMATIC, 14in.
Heavy Duty VERTICAL MILLING and PROFILING MACHINE, complete with 26in. rotary table, spindle 3 5-8in. dia., 4-speed cone for 4in. belt, power feeds all directions.
"Pratt and Whitney" 2in. CAPSTAN LATHE, P.F. to turret and cross slide.
ONE "Ernsaught" Light VERTICAL MILLING MACHINE.
SEVEN 4in. WIRE FEED CAPSTANS.
All these machines are in excellent condition and immediate delivery can be given.
JOSEPH PUGSLEY and SONS, Ltd.,
MACHINE TOOL DEPT.,
LAWRENCE HILL, BRISTOL. Ex.

WEIR Steam-driven BOILER FEED PUMPS, 2000, 3600 and 10,000 gals. per hour, with gun-metal water ends.
Double-cylinder Reversing STEAM WINCH, by Clarke, Chapman, cyls. 6in. by 10in.
TWO DITTO, by Ruston, cyls. 4½in. by 6in.
HARRY H. GARDAM and CO., Limited, Staines. 'Phone 98. Send for our latest catalogue. 5800 G

200 H.P. HORIZONTAL DOUBLE-ACTING STEAM ENGINE, by G. Saxon and Sons, Ltd.; working pressure, 120 lb. per sq. in. (condensing). Recently overhauled.—Address, 5739, The Engineer Office. 5739 G

200 TONS NEW WIRE ROPES, Half Price.—THE LONDON ELECTRIC FIRM, Croydon. 5088 G

FOR SALE

256 H.P. OPEN HEARTH SUCTION GAS PLANT.

"F" Type, by Messrs. Crossley Bros., Ltd., Manchester.
Complete with Generator, Vaporiser, Scrubber, &c. Used only on Anthracite.
Also
3 H.P. CROSSLEY PARAFFIN ENGINE
Complete for use with above Plant for Converting to Pressure Plant.
PRACTICALLY NEW. Full particulars from—
JOHN CASHMORE,
GREAT BRIDGE, Staffs.

400 H.P. HORIZONTAL CROSS-COMPOUND STEAM ENGINE, by G. Saxon and Sons, Ltd.; working pressure, 120 lb. per sq. in. (condensing).—Address, 5740, The Engineer Office. 5740 G

500 K.W. 2000-Volt 3/50 Belliss-E.C.C. GENERATING SET, excellent condition; low price.—HARRY H. GARDAM and CO., Limited, Staines. 5197 G

500 K.W. 2200 Volts 3-phase 50 Cycles, Belliss-Siemens IMPULSE TYPE MIXED PRESSURE STEAM TURBO-ALTERNATOR, complete with Mirrlees-Leblanc Multi-Jet Condenser, Circulating Pumps, Switchgear, Oil Cooler, Pipework, Steam Receiver and all accessories. All in first-class condition.—Full particulars, D. R. LLEWELLYN and SONS, Ltd., Bank Chambers, Victoria-square, Aberdare, South Wales. P3353 G

WORK WANTED

WANTED to MANUFACTURE, SPECIAL MACHINERY or ENGINEERS' APPLIANCES. Up-to-date machine plant for either heavy or medium work. Own foundry and pattern shop.—EASTON and JOHNSON, Ltd., Engineers, Taunton. Ex. M

WORK WANTED

THE HEATLY-GRESHAM ENGINEERING Co., Ltd.,

Gresham Iron Works, LETCHWORTH. OR 48, Wood St., Westminster, LONDON, S.W. 1.

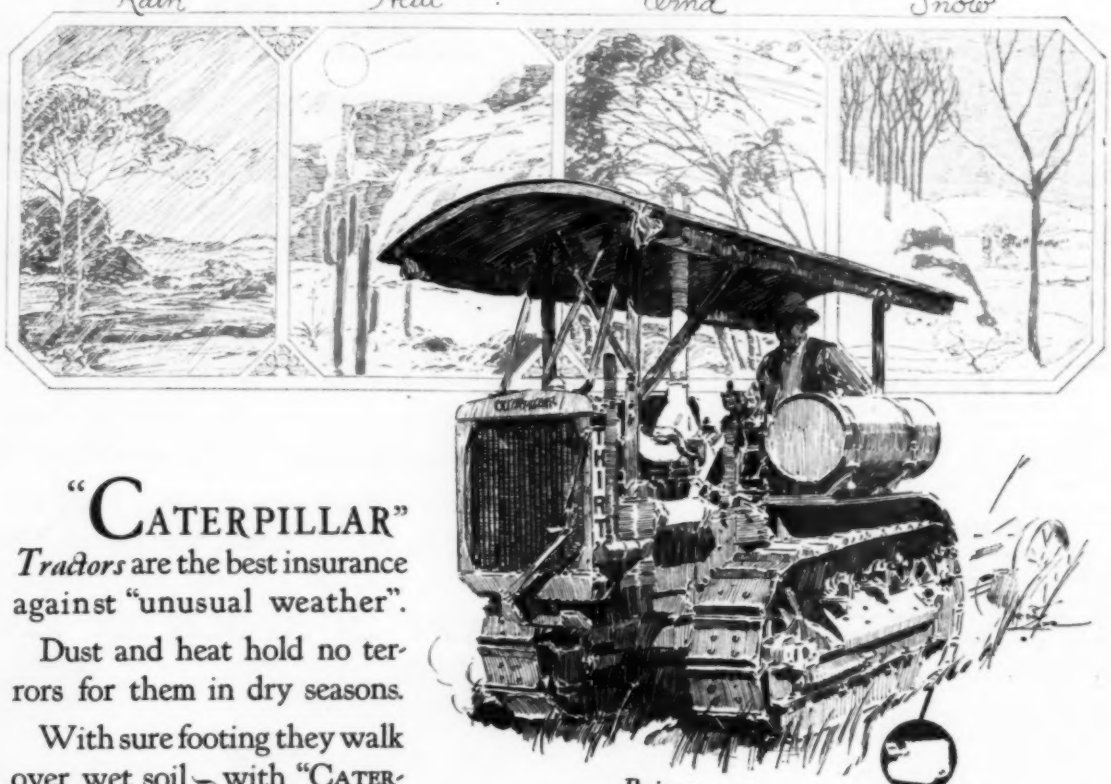
ACCURATE & WELL-FINISHED
IRON CASTINGS
EASILY MACHINEABLE.
LARGE CAPACITY FOR REPETITION WORK.

DROP FORGINGS. PATTERNS. MACHINING DEEP PRESSINGS. ASSEMBLING

WELL ORGANISED ENGINEERING WORKS with MODERN TOOL EQUIPMENT and laid out for the EFFICIENT PRODUCTION of Heavy and Medium ENGINEERING WORK of every description. Open to
UNDERTAKE BUILDING INDIVIDUAL MACHINES to Customers' drawings.
MACHINING COMPONENTS or MANUFACTURING MACHINERY in Quantities on Production Lines.
Enquiries Invited. Note New Address.
PIERCY & CO., LTD., MINERVA WORKS, Oozells Street, Birmingham.
Tel.: 20 Midland. Telegrams: "Piercy, Birmingham."

Z. D. BERRY and SONS, Engineers, The Albion Works, Regency-street, Westminster, S.W. 1 (established 1810), UNDERTAKE MACHINING and GENERAL WORK. Lathes up to 9in. centres with Gap Beds, Capstans, Automatics for bar work, Radial and Vertical Drills, Planing up to 9ft. by 4ft. by 4ft., Shaping, Milling, Gear Cutting to 36in. dia., Internal, External and Surface Grinding, Hand Forging, Small Press Work, &c. 5086 M

BIGGER
than the Weather



"CATERPILLAR" *Tractors* are the best insurance against "unusual weather".

Dust and heat hold no terrors for them in dry seasons.

With sure footing they walk over wet soil—with "CATERPILLAR" track-type tractors, the working season is lengthened

for—FARMER
CONTRACTOR
ROAD-BUILDER
LOGGER

...*Prices*...

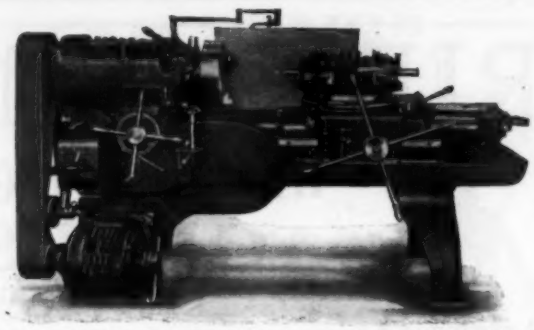
2-TON	THIRTY	SIXTY
$1850	$3000	$5000
Peoria, Illinois U.S.A.	*Peoria or San Leandro U.S.A.*	*Peoria or San Leandro, U.S.A.*

better quicker cheaper

CATERPILLAR TRACTOR CO.
Executive Offices: San Leandro, California, U.S.A.
Sales Offices and Factories:
Peoria, Illinois San Leandro, California
New York Office: 50 Church Street
Successor to
BEST C. L. Best Tractor Co. The Holt Manufacturing Company HOLT
Cable Address: "CATERPILAR" SAN LEANDRO

7227

CATERPILLAR
Registered Trademark.



15in. SWING "J & L" HARTNESS FLAT TURRET LATHE, "Steel Head" Model.

MERIT AND METHOD.

The Hartness Flat Turret Lathe with cross sliding headstock brought a new era in Chucking Work because it gave high speed steel tools a chance to do their work as metal removers.

The merits and methods of the "HARTNESS" for Chucking Work are discussed in "THE PROBLEMS OF YOUR SHOP—PROBLEM No. 3."

In case this booklet has not come to your attention, a request to us will bring you one.

JONES & LAMSON MACHINE CO.,
19, WATER LANE, LONDON, E.C. 4.

Joliac

— GRAPHITE —

AND ITS MANY USES.

WRITE FOR COPY OF BOOKLET F. 9 FREE.

GRAPHITE PRODUCTS Ltd., 218-220, QUEEN'S ROAD, BATTERSEA, LONDON, S.W. 8.

FLAMEPROOF ELECTRIC COAL DRILLS

Certified by SHEFFIELD UNIVERSITY.

Every Colliery with 3-phase Supply can **ECONOMISE** by installing our Hand-Operated **COAL DRILLING MACHINE.**

The SAVING in TIME and LABOUR is astounding.

Many Collieries are already equipped. Why not you?

LIGHT WEIGHT. LOW CONSUMPTION. FOOLPROOF and RELIABLE

For **PARTICULARS** and free **DEMONSTRATION** apply to:

Siemens-Schuckert (Great Britain) Ltd.,
109, Kingsway, London, W.C. 2.

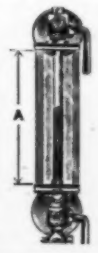
Scottish Agents:
FRASER & BORTHWICK, Ltd.,
59, Pitt Street,
GLASGOW.

The "GLODEX" WATER LEVEL INDICATOR

(PATENTED)

With this device the water in the glass can clearly be seen (in red) at any distance.

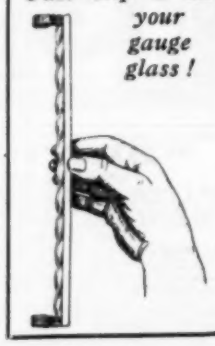
NO ALTERATION to existing fittings NECESSARY



Used by
H.M. GOVERNMENT,
LEADING GAS WORKS,
ELECTRIC POWER STATIONS,
SHIPPING COMPANIES, etc.

SIMPLE, RELIABLE, ECONOMICAL.

Just clip it on your gauge glass!



Write for List.

BERNON-WALKER Co., Limited,
Engineering Specialists,
58, Westbourne Grove, LONDON.

Telephone: Park 5524. *Telegrams:* Bernovator, Westbourne, London.

A 67 B.H.P. Gardner Heavy Oil Engine saves 50/- per day.

FARNWORTH,
April, 1927.

DEAR SIRS,

No doubt you will be interested to learn that the engine you installed two years ago has exceeded all my expectations, as the cost per B.H.P. is even less than you gave me to expect. It runs for 7¼ hours each day, during which time it consumes 24 gallons of heavy oil at 6d. per gallon. The steam engine I had previously required 2 tons of coal per day at 23/6 per ton, plus cartage 4/- per ton.

One other point, I have now been able to dispense with the services of the fireman, which accounts for a further economy of 45/- per week.

J. O.

The letter here published emanates from the proprietor of a Lancashire Brick Works and it is typical of many we receive testifying to the economy of Gardner Heavy Oil Engines.

HORIZONTAL MODELS, cold starting, up to 218 B.H.P.

GARDNER HEAVY OIL ENGINES.

VERTICAL MODELS up to 500 B.H.P. 1, 2, 3, 4 and 6 cylinders

L. GARDNER & SONS, LTD., PATRICROFT, Manchester.
London Office - 115, Queen Victoria Street, E.C. 4.

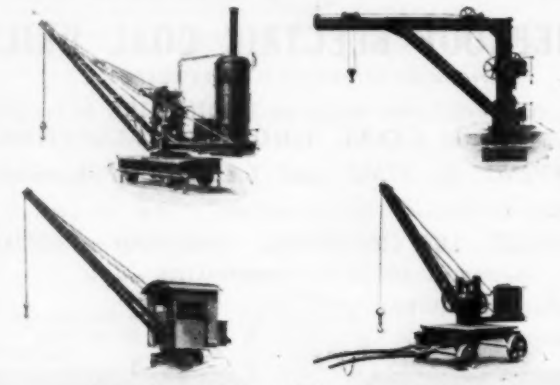
WE CAN LEND YOU A HAND.

THOMAS PIGGOTT & CO., LTD.
SPRING HILL, BIRMINGHAM.

TANKS FOR WATER STORAGE FROM STOCK.

The Strongest on the Market. **15,000 Tons supplied.**

CRANES *for* Yards, Dock Sheds Warehouses, etc.

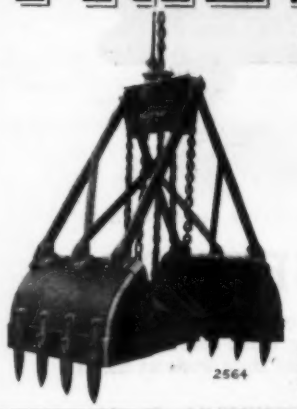


ELECTRIC : STEAM : HAND
SEND US YOUR ENQUIRIES

GIBBINS SAVES LABOUR LIFTING

RICHARD C. GIBBINS & CO.
BERKLEY STREET
BIRMINGHAM
"Make Light of Heavy Jobs"

PRIESTMAN



HEAVY WEIGHT
GRABS
for EXCAVATING, and for handling ORE, BROKEN STONE, etc., etc.

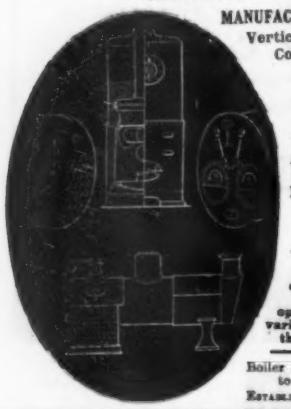
"Stand an enormous amount of rough usage."
—User's report.

62 PRIESTMAN GRABS SUPPLIED TO ONE CONTRACTOR

PRIESTMAN BROS., LTD., HULL AND LONDON.
Phones:- {Hull, Central 5228 (4 Lines) {London, Victoria 6171. Cables:-PRIESTMAN, HULL.
BUILDERS OF GRABBING EQUIPMENT SINCE 1875

"BRITNIC"
—4,000,000 H.P in service—
WATER TUBE BOILERS & MECHANICAL STOKERS.
200,000 H.P. in service.
THE BRITISH NICLAUSSE BOILER CO., LTD.,
The Clock House, Arundel St., Strand, W.C.

The Grantham Boiler & Crank Co., LTD
GRANTHAM.



MANUFACTURERS of Vertical, Loco., Cornish, Field Tube, Colonial, &c

Also Air Receivers, Feed-Water Heaters, &c.

Thousands of Boilers in successful operation in various parts of the World.

Boiler Makers to the Trade.
ESTABLISHED 1865.

DRUM PUMP
DRUM ENGINEERING CO. LTD.
BRADFORD · YORKS.

SPONS' TECHNICAL BOOKS
WRITE FOR A CATALOGUE OR REPORT OF ANY ENGINEERING OR TECHNICAL BOOK YOU MAY REQUIRE
VISIT OUR RETAIL BOOK ROOM WHERE ALL BOOKS ON ENGINEERING AND TECHNOLOGY MAY BE INSPECTED
E. & F.N. SPON LTD.
57 HAYMARKET LONDON S.W.1.

THE ENGINEERS' CLUB.
39, Coventry Street, W.1.
Annual Subscriptions:—Town Members £10 10 0
Country " 5 5 0
Overseas " 2 2 0
72 Bedrooms.
Application for membership should be sent to "The Secretary" at the above address.

The Burckhardt Engineering Works
COMPRESSORS. VACUUM PUMPS.
Works: Basle, Switzerland.
76, Victoria Street, London, S.W.1.

WRIGHT, ANDERSON & CO., Ltd.,
STRUCTURAL ENGINEERS,
Telegrams: CONSTRUCT, GATESHEAD. GATESHEAD-ON-TYNE.
ROOFS, SHEDS, STEEL FRAMED BUILDINGS of every description.
See Illustrated Advt. on page 69 issue of June 17th.

"EMPIRE" High Tension Line Equipment.
Pole-type switches, disconnecting switches, choke-coils, lightning arresters, and "Empire" S & C Fuses up to 130,000 volts.
ELECTRIC CONTROL LIMITED, GLASGOW.
Manufacturers also of "Empire" Automatic Control Gear.
Birmingham, Leeds, London, Manchester, Paris.

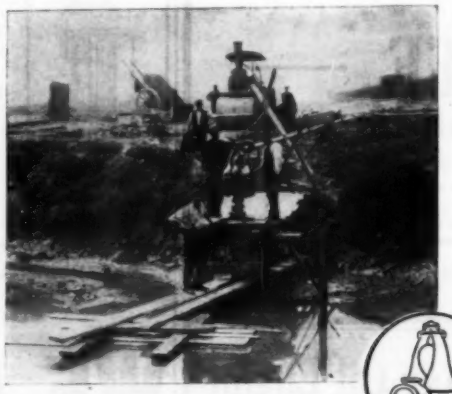
SYMBOLS OF A NOTED INDUSTRY

REFRIGERATION

STEREOPHAGUS

TURBINE

CENTRIFUGAL



The Handy & Hardy
"PULSOMETER" PUMP

Handy it is, and always ready. It does not even want fixing before it begins its job. Hardy, too—for it needs no roof over it, and it will go on pumping year after year without repairs—except just now and then it requires a new valve, which a labourer could put in.

It passes dirt or grit without a murmur.

Write for List No. 1140.

The Pulsometer Engineering Company specialises in the design and manufacture of pumping and refrigerating machinery of all kinds. Suggestions as to the most suitable installations for your requirements will be sent on receipt of particulars.

Pulsometer Engineering Co. Ltd
NINE ELMS IRONWORKS · READING
London Offices: 11 TOTHILL STREET, S.W.1

Code: Marconi International. Telegrams: Expanders, Glasgow
On the Admiralty and War Office Lists.
Contractors to Crown Agents for the Colonies

THOMSON'S
PATENT PULLEY BLOCKS
are unrivalled for
Durability, Speed, Easy Running, and Lifting Power.

They are constructed from the very best materials and fitted with Chains of first-class quality.
The Thomson Type is the only self-sustaining Block both in raising and lowering goods without the application of brakes or friction gear.
The double threaded Block with bottom Block is easily the best of its type in the market.

Also Manufacturers of
RUNWAYS, TROLLEYS, DUDGEON PATTERN EXPANDERS, TUBE CUTTERS, WORMS, SPINDLES and various other classes of MACHINE TOOLS.

Ask for Thomson's original and genuine Pulley Blocks.

Wm. THOMSON & Co. (Kinning Park), Limited,
47/57, Smith Street, GLASGOW, S. 1.
MAKERS OF PULLEY BLOCKS FOR 88 YEARS.

KAYE'S ORIGINAL PATENT SEAMLESS STEEL SERRATED VALVE OILCANS, etc.

Pattern No. 49—1 Pint.
Seamless Steel Torch Lamps.
Sizes ½ Pint, 1 Pint and 2 Pint.

Pattern No. 8—½ Pint.
178,500 supplied to the British Admiralty during 21 years' successive Contracts, 1903 to 1924.
Sizes ½ Pint to 2 Pint.

ASK FOR LIST.

Oil Economisers.
Wasteless Handling of Oil.
Sizes 1 Gall. to 100 Galls.

Small Motor Oilcans.
Two Sizes No. 81 and 82.

93, HIGH HOLBORN, LONDON, W.C. 1.

JOSEPH KAYE & SONS, Ltd., Oilcan Works, LEEDS.

"SIMONS" PATENT CUTTER HOPPER DREDGERS

TRAILING SUCTION HOPPER DREDGERS . . . .
GOLD & TIN RECOVERY DREDGERS . . . .
HOPPER BARGES. FERRY STEAMERS.
REPLACE PARTS for EXISTING DREDGERS.

MARINE DREDGE PLANTS— of all descriptions and up to the highest capacity.

CONSTRUCTORS OF HOPPER & BARGE-LOADING BUCKET DREDGERS; BARGE-LOADING, RECLAMATION & "SIMONS" CUTTER SUCTION DREDGERS.

INVENTORS and FIRST CONSTRUCTORS . . .
OF "HOPPER" and "STERNWELL . . .
DREDGERS and ELEVATING . . .
DECK FERRY STEAMERS . . .

Telegraphic Addresses
SIMONS, RENFREW; SIMONIUS, LONDON.
CODES: A B C 5th Edition,
SCOTT'S, 10th Edition.
BENTLEY'S.

Proprietors of ALFRED WATKIN'S BRITISH PATENT for ROTARY SPUDS.

Builders of Dipper and Drag Line Dredgers of the latest type.

London Office:
83, VICTORIA STREET.

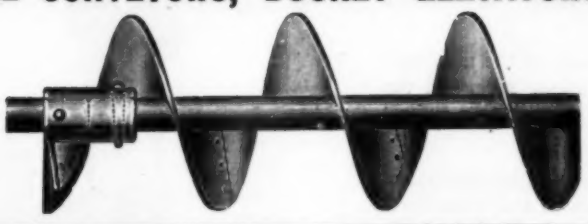
WM. SIMONS & CO., Ltd., RENFREW, near GLASGOW.

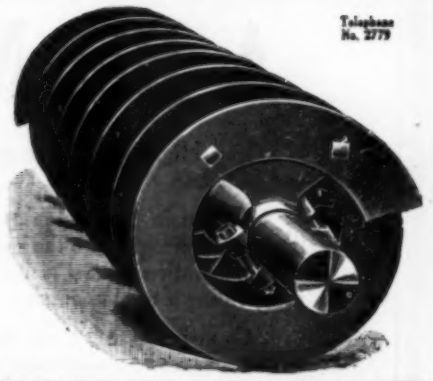
CONVEYOR AND ELEVATOR Co Ltd.

Telegrams: Conveyor, Accrington."

LOWER BRIDGE WORKS,
ACCRINGTON, LANCASHIRE.
Contractors to H.M. Government.
SPIRAL CONVEYORS, BUCKET ELEVATORS, ETC.

Telephone No. 2779





Thor CHIPPING HAMMERS

More Work Per Man.

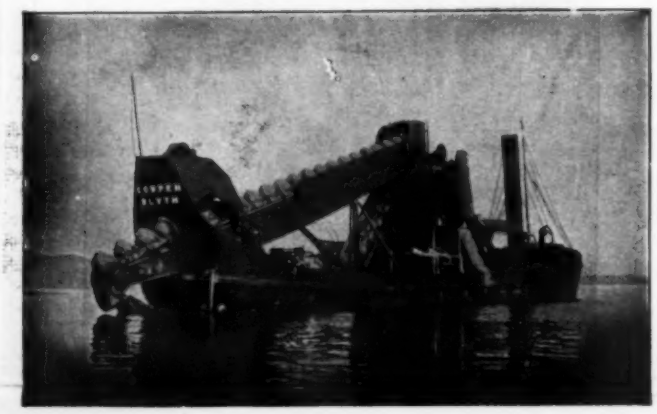
Your biggest problem is to increase production and cut down costs. Competition is too keen to allow you to remain satisfied with present conditions if there is an opportunity to improve. *Thor* Pneumatic Chipping Hammers are proving their worth every day. Their rapidity and accuracy of operation speed up production and lower costs. They are powerful, durable and smooth running —always ready for a good day's work. Let us send you our complete catalogue.

INDEPENDENT PNEUMATIC TOOL COY.,
BROADWAY, WESTMINSTER. LONDON, S.W. 1.
Telegrams: "Thórtool," Sowest, London. Cables: "Thortool," London. Telephone: Victoria 6655

Weldless Steel
TUBES
of every description
are produced by

BROMFORD TUBE CO., LTD.
BIRMINGHAM

DREDGING PLANT



UP TO THE LARGEST DIMENSIONS AND CAPABILITIES.

Bow and Stern Well Centre and Side Ladder Bucket, Barge-Loading and Hopper Dredgers, Suction Dredgers, Cutter Dredgers, Trailing Dredgers, Reclamation Dredgers, Grab Dredgers, Hydraulic and Mechanical Agitators, Discharge Pipes and Pontoons, Hopper Barges, Sewage Steamers, Caissons, Tugs, Ferries, Paddle and Screw Steamers.
Delivered Complete or Shipped in Sections. Spare Gear and Renewals Supplied.

FERGUSON BROTHERS (PORT GLASGOW), LD.
Shipbuilders and Engineers,
PORT GLASGOW.
Telegraphic Address: DREDGER, PORT GLASGOW.
On Admiralty List and War Office List.
GRAND PRIZE, LONDON EXHIBITION, 1908.
GOLD MEDAL, JAPAN-BRITISH " 1912.

HEAVY OBJECTS MOVED WITH EASE & SAFETY

A Jack of unlimited uses, possessing many unique advantages. SPECIALLY USEFUL IN AWKWARD CORNERS AND IN CONFINED SPACES. Can be anchored in any position, and gives a straight even pull under perfect control.

The "LITTLEJACK" PULLING JACK

enables any ordinary workman to move heavy machinery, girders, castings and wagons. Also specially useful for cable pulling, uprooting trees, portable crane, pit prop pulling, hoisting and lowering, etc.

WONDERFUL CAPACITY — GREAT ADAPTABILITY
MECHANICALLY SOUND.

A REAL TIME AND LABOUR SAVER

"There's POWER in it's pull"

The "LITTLEJACK" is used by some of the largest firms in the Kingdom. If you would like to know more about the merits of this efficient appliance write NOW for

FREE ILLUSTRATED LIST.

The 'LITTLEJACK' ENGINEERING Co., Ltd., MANSFIELD.

THE "CASTLE" 12" CIRCULAR SAW BENCH

Screw Rising Table Top.

DESIGNED to meet the requirements of those who require a circular saw for light accurate sawing and general jobbing work, and is a handy tool for joiners', cabinet makers', and pattern makers' shops, where the workmen's benches are placed.

SPECIFICATION.

TABLE TOP.—The table is planed all over, both top and edges, grooved for mitre gauge, fitted with removable plate at the saw. Rising and falling mechanism actuated by means of a large screwed handwheel mounted on a central column, and is locked in position by a handwheel and screw.

SAW SPINDLE.—Runs in one long self-oiling phosphor bronze bearing, with two rings which dip in container formed in centre column.

RIPPING FENCE.—Which will cant for bevel cutting, and throw over end of machine when cross-cutting. Riving knife is fitted.

CAPACITY.—Will take saws up to 12in diameter and with the table in the lowest position the saw projects 4in. through the table. Maximum distance between saw and fence is 9in.

12in. best quality saw, fast and loose pulleys for 2½in. belt, and a positive strap guard.

Price Complete as Illustrated £15.

J. W. & C. J. PHILLIPS, Ltd., 23, COLLEGE HILL, CANNON STREET, London, E.C. 4.

A Big Machine for the Big Jobs.

For High Speed Heavy Duty Drilling, Boring, Tapping and Studding.

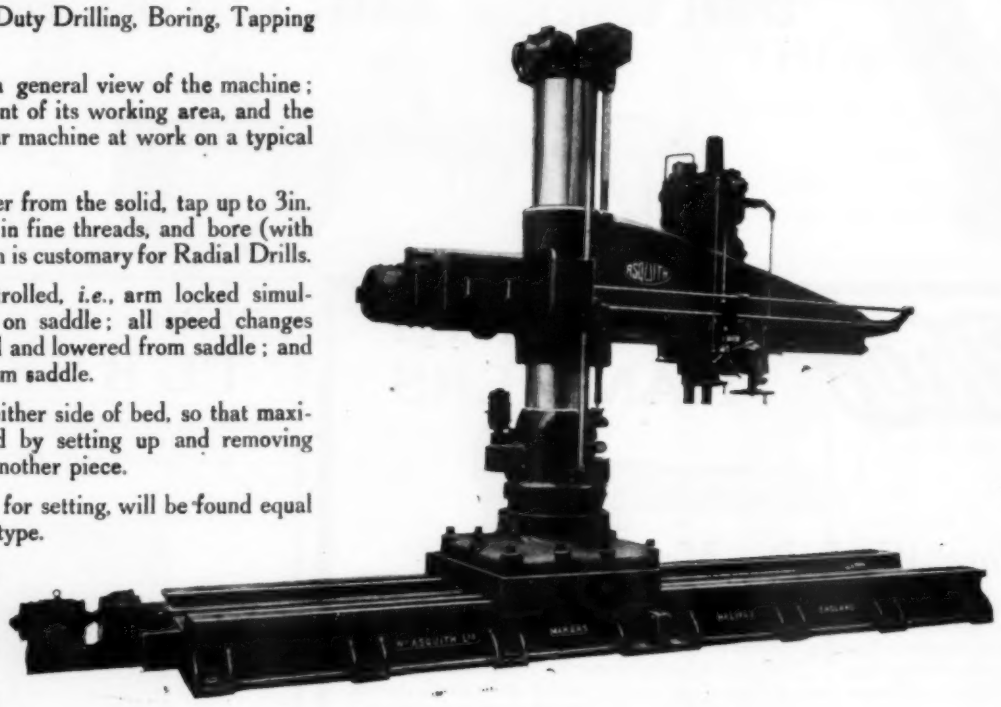
The main illustration is a general view of the machine; the line drawing shows the extent of its working area, and the third illustration shows a similar machine at work on a typical job (drilling a turbine casing).

Capacity up to 3in. or larger from the solid, tap up to 3in. Whitworth and proportionately in fine threads, and bore (with bar and cutter) much larger than is customary for Radial Drills.

All motions centrally controlled, *i.e.*, arm locked simultaneously with saddle by lever on saddle; all speed changes effected from saddle; arm raised and lowered from saddle; and machine traversed along bed from saddle.

Work can be drilled at either side of bed, so that maximum drilling output is ensured by setting up and removing work while drilling is done on another piece.

One machine, with helpers for setting, will be found equal to several machines of ordinary type.



IMPORTANT NOTICE.

Please address all Enquiries to us direct, as we have now resumed entire control of our own Sales.

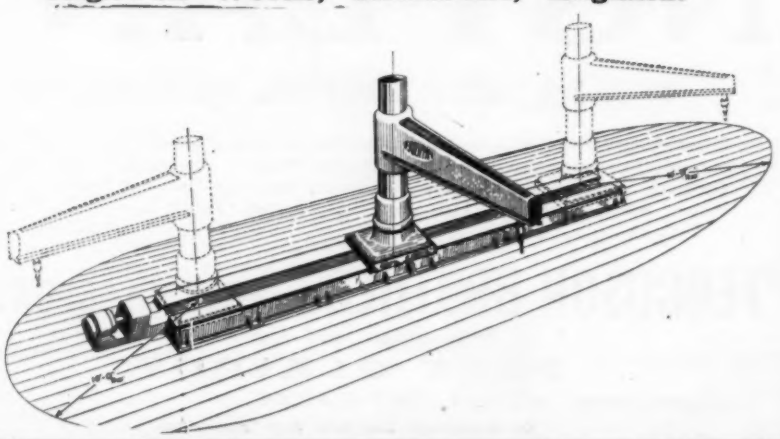
Enquiries solicited for ALL SIZES and CLASSES of Drilling and Boring Machines, Radial, Vertical and Horizontal, from the smallest sizes upwards.

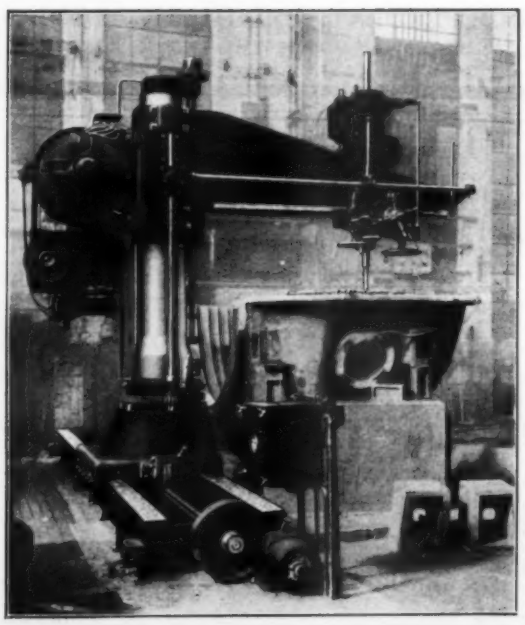
WILLIAM ASQUITH (1920) LTD.

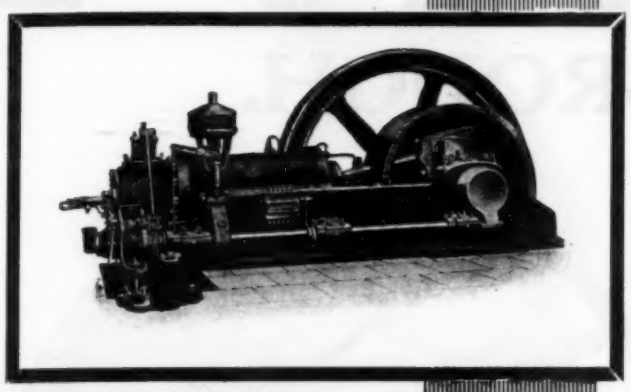
ESTABLISHED 1865.

The Largest and Leading Drilling Machine Specialists,

Highwell Works, HALIFAX, England.

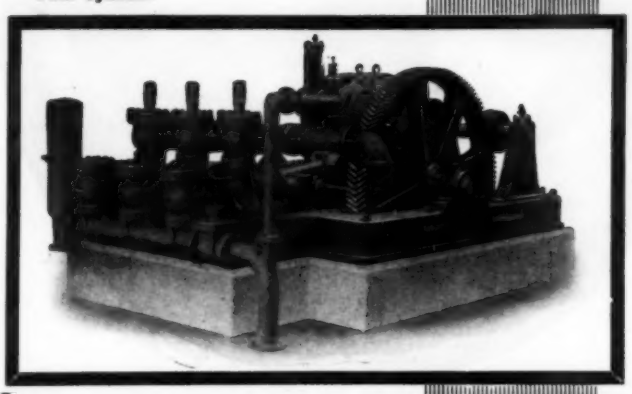






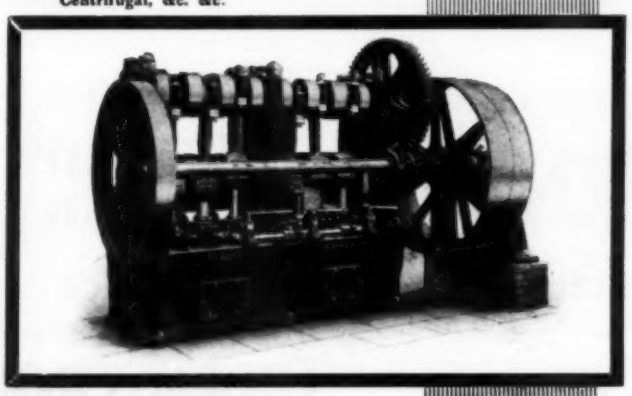
HEAVY-FUEL OIL ENGINES.

Single,
Coupled and
Twin Cylinder.



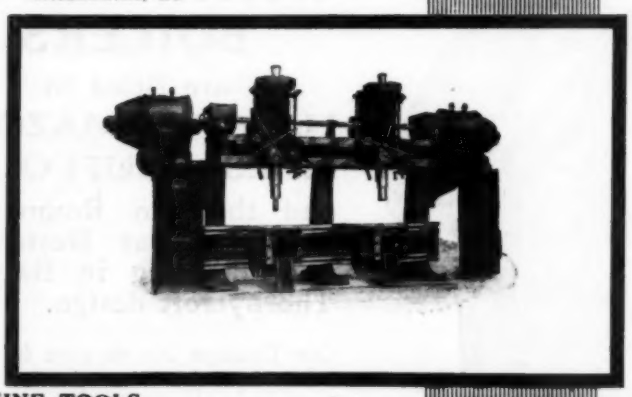
PUMPS.

Ram,
Turbine,
Steam,
Centrifugal, &c. &c.



HYDRAULIC MACHINERY.

Presses,
Testing Machines,
Accumulators, &c.



MACHINE TOOLS.

Lathes,
Drilling Machines,
Shaping Machines,
&c. &c.

TANGYE

TANGYE PRODUCTIONS

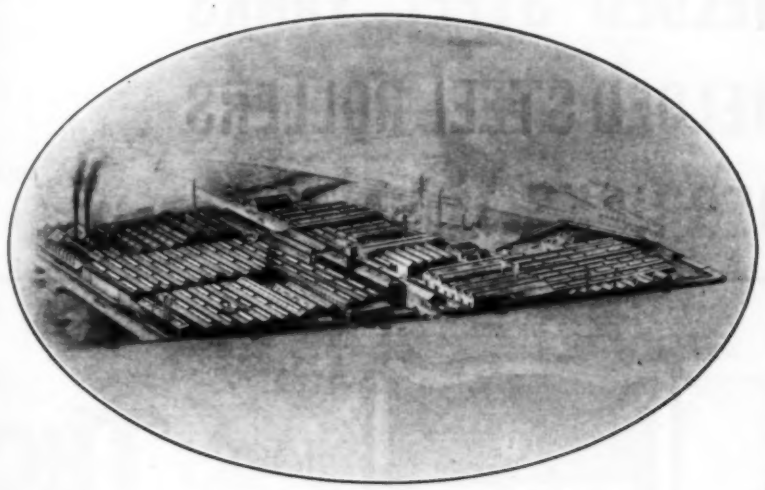
HAVE

WORLD-WIDE REPUTATION

FOR

RELIABILITY.

View of Cornwall Works, Birmingham.



Taken from an Aeroplane.

COMPLETE PUMPING PLANTS.
HEAVY-FUEL OIL ENGINES.
GAS ENGINES.
HYDRAULIC MACHINERY.
STEAM ENGINES.
PUMPS (Steam and Power).
MACHINE TOOLS.
LIFTING TACKLE.
MALLEABLE CASTINGS.
&c. &c.

Catalogues post free.

Quarry Plant Exhibition,
Harrogate,
June 28 - July 1.
STAND No. 83.

TANGYES LTD. — BIRMINGHAM.

B

COCHRANE & CO. LTD.
MIDDLESBROUGH.

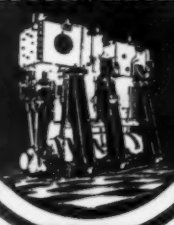
STEEL PIPES

FOR EVERY PURPOSE.

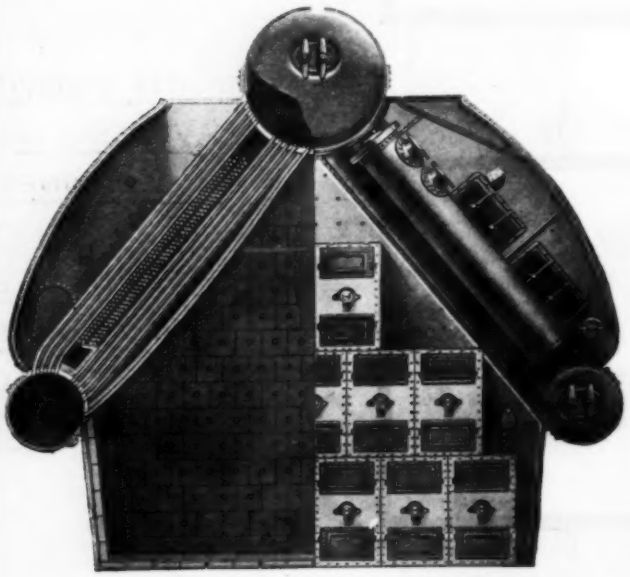
PRESSED STEEL TANKS
WELDED STEEL TANKS
WELDED STEEL ROLLERS
DERRICKS AND MASTS.

MILD STEEL WATER PIPE WITH TALBOT HYDRO-CARBON LINING
(from unretouched photograph).

TORPEDO BOAT DESTROYERS
PASSENGER AND CARGO VESSELS
SHALLOW DRAFT BOATS. TUGS
STEAM & MOTOR BOATS & YACHTS
TURBINES AND RECIPROCATING MACHINERY
WATER TUBE BOILERS
OIL FUEL GEAR
PROPELLERS
SHIP REPAIRS & OVERHAULS
STATIONARY & MARINE MOTORS
COMMERCIAL MOTOR VEHICLES



JOHN I. THORNYCROFT AND CO LIMITED
ENGINEERS SHIPBUILDERS & SHIP-REPAIRERS



THORNYCROFT
"EXPRESS"
WATER TUBE BOILERS
are fitted to
H.M.S. "AMAZON"
H.M.S. "SUFFOLK"
and the two Roumanian Torpedo Boat Destroyers now building in Italy to Thornycroft design.

Our Catalogue No. 40 gives full particulars of our latest types for coal, oil, or wood fuel. Illustration shows our latest type with superheater.

WOOLSTON WORKS, SOUTHAMPTON.
London Offices—Thornycroft House, Westminster S.W.1.

2 HANDS ARE BETTER THAN 1

Equip your Drawing Office

with

AXENE MAGNETIC TEE SQUARES

and

DRAWING BOARDS

because they mean greater speed with greater efficiency.

THE OUTSTANDING FEATURES OF OUR EQUIPMENT ARE:

1. It is sound and practical and the worker is enabled to use both hands all the time.
2. While the Tee Square remains dead true to position it slides smoothly when required.
3. The special stainless steel working edges are scientifically more accurate than the usual ebony edges, and are, moreover, much more durable.
4. No clamps, no springs, no wires, no pulleys, no special drawing tables are needed—all these are banished by efficient magnetic action.
5. It compares favourably in cost with any other first-class production.
6. The leading users are unanimous in their recommendation. They include the Government Departments, Borough Councils, and the chief engineering and industrial concerns.

WRITE TO US NOW.

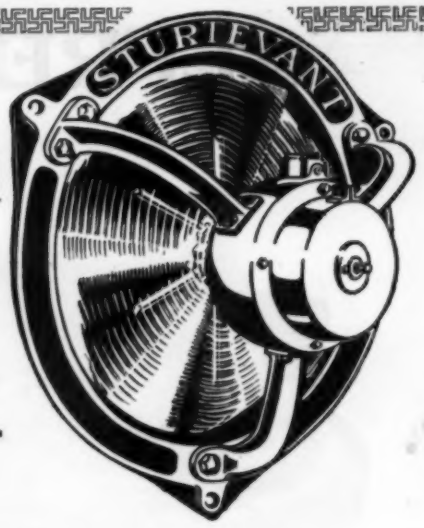
AXENE LIMITED,

35, Maxwell House,

Arundel Street, London, W.C.2.

O & S

Fresh Cool Air—



Everybody's need in the summer. When the atmosphere becomes hot and stifling, how all long for a soft cool breeze just enough to circulate the air around.

The Sturtevant Company are experts at doing this, either by means of a ventilation system or by propeller fans. Write for catalogue E. 1243 and E. 1067.

STURTEVANT ENGINEERING Co. Ld

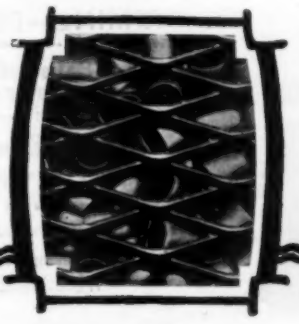
MANCHESTER: 196, Deansgate. *149, Queen Victoria St.,* **LONDON** E.C. 4 GLASGOW: 50, Wellington St.

VISCO AIR FILTER

removes 98% dirt from air.

Air Filters are essential to the efficient operation of compressors, turbo-alternators and transformers. The best filter for the purpose is the "Visco." This delightfully simple filter removes 98% of the impurities in the air. The dust, fluff, soot and sand with which the air is charged is deposited on the jumble of sticky rings with which the "Visco" is packed.
Clean, pure air reaches the machine fitted with a "Visco" foolproof Air Filter. Write for list.

4,500 Plants are equipped with "Visco" Air Filters.



THE VISCO ENGINEERING COMPANY, LTD,
162, Grosvenor Road,
LONDON - - S.W.1.

Makers of "Visco" Cooling Towers.

KIH

ALFRED HERBERT LTD.
COVENTRY

CHANGE GEARS.
Ground on both faces. Removed ½" from each face. Fifty-six ground together in total time of 16 minutes. Material: Cast Iron.

CHANGE GEAR QUADRANTS.
Ground on two sides. Two sizes—15 small and 12 large ground together. Removed ⅛" metal from each side in total time of 24 minutes. Material: Cast Iron.

HOW WOULD YOU MACHINE THIS CLASS OF WORK?

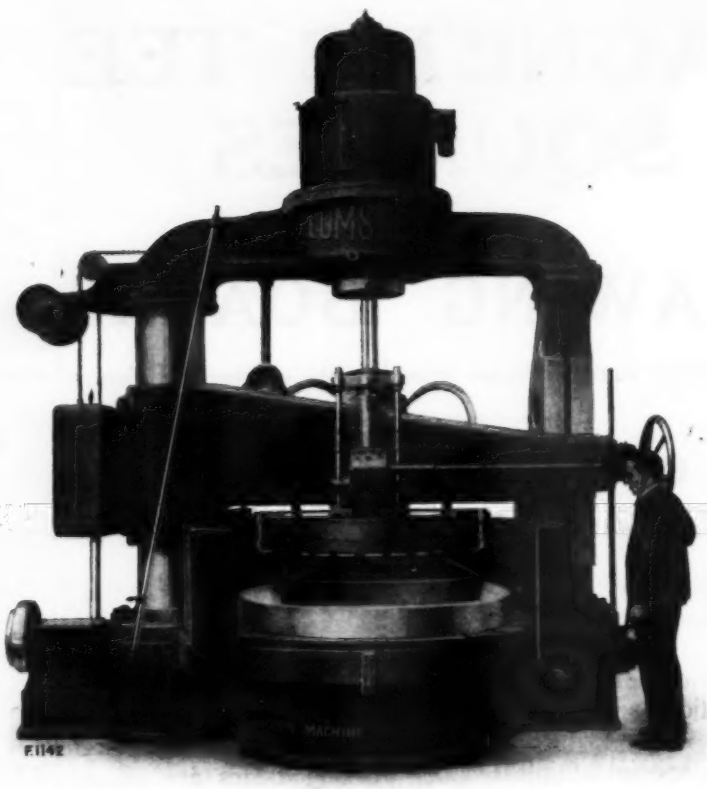
WOULD you face the gears on a lathe and mill the quadrants? Would you use methods which are rapidly becoming obsolete? Not if you know the possibilities of Lumsden Surface Grinders.

For work such as that illustrated Lumsden Rotary Table Surface Grinders fitted with magnetic chucks will reduce production costs to a minimum.

There are other types of Lumsden Surface Grinders with vertical and horizontal spindles, reciprocating and stationary tables for dealing efficiently with a wide range of work.

The Lumsden specialist will be glad to discuss the possibilities of a machine in your works.

ASK FOR GUARANTEED PRODUCTION TIMES.



LUMSDEN No. 94 SURFACE GRINDER.
Capacity: 72" dia. × 36" high.

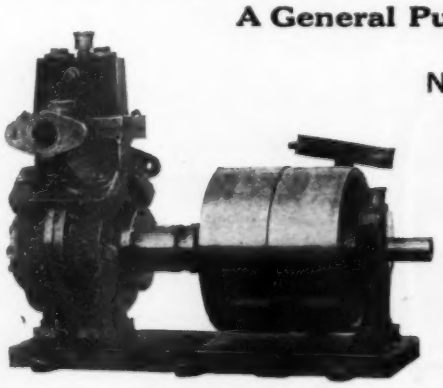
SIMPLE AND EFFICIENT

MEPSTEAD'S (PATENT) ROTARY PUMP

A General Purpose Positive Pump with Rotating Plunger.

CAPACITIES FROM 250 GALS. PER HOUR.

NO PRIMING—PERFECT SUCTION.



Used by Satisfied Clients for Pumping at Pressure — Water — Oils — Petrol — White Spirit — Varnish, Etc.

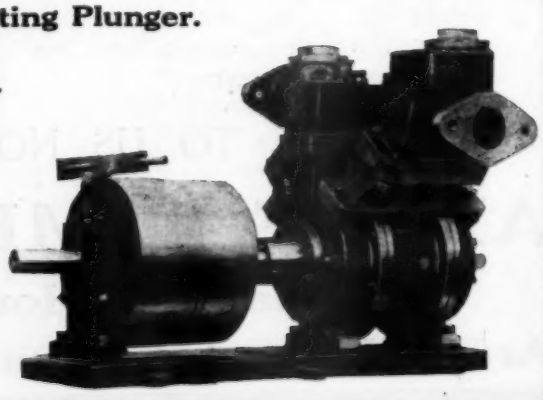
WE GUARANTEE our PUMPS for 12 MONTHS.

LIST UPON APPLICATION.

MEPSTEAD & CO.,

Stanton Engineering Works, Villiers Road, WILLESDEN GREEN, LONDON, N.W. 2.

Telegrams: *Inland*— "Pumpmep, Willroad, London." *Foreign & Cables:* "Pumpmep, London." Code: Private. Telephone: Willesden 3047.



ALFRED HERBERT LTD
COVENTRY

THE LITTLE THINGS THAT COUNT.

WHEN it is found that production is suffering because a machine tool is obsolete steps are usually taken to instal a more modern machine. Obsolete small tools, however, are very often neglected, yet their collective effect on production is considerable. The little things are quite as important as the larger ones.

Pay a visit to our Small Tool Warehouses where all the most modern labour-saving small tools and accessories, together with large stocks of Norton grinding wheels, are obtainable.
All items are guaranteed for their respective purposes and prices are strictly competitive.

ASK FOR A COPY OF THE 9th EDITION SMALL TOOL CATALOGUE.

SMALL TOOL WAREHOUSES AT:—

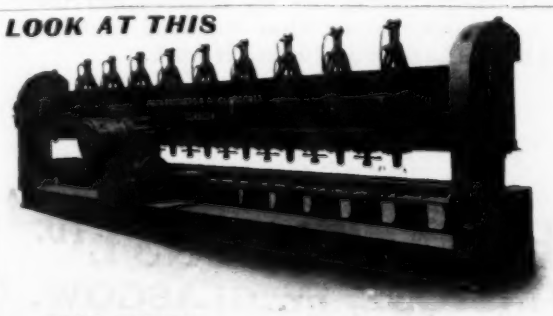
COVENTRY: The Butts.
LONDON: 25, Victoria Street, S.W. 1.
BIRMINGHAM: 208, Corporation Street.
MANCHESTER: 2, Whitworth Street West
GLASGOW: 36-38, West George Street.
BRISTOL: 94, Redcliffe Street.
NEWCASTLE: New Market Street.
Stocks carried in Ireland by John Hind & Sons, Ltd., 75, Great George's Street, BELFAST.

ESTABLISHED 1854.

SMITH BROTHERS & CO. (GLASGOW), LTD. Kinning Park, GLASGOW.

MACHINE TOOL MAKERS for Shipyards, Boiler Works, Iron & Steel Works, Bridge & Wagon Builders

LOOK AT THIS



RACK DRIVEN

THE LAST WORD IN PLATE EDGE PLANING.

SOME ADVANTAGES:

OPERATOR CAN START, STOP OR REVERSE WITHOUT LEAVING SADDLE PLATFORM.

Running Costs Reduced 50%
Maintenance Costs ,, 60%

CAN CUT UP TO 60 FEET PER MINUTE.

SPECIALITIES:

MACHINES for BENDING, PUNCHING, SHEARING, PLANING, STRAIGHTENING, SCARFING, FLANGING and JOGGLING. Also for SHEARING and BENDING ANGLES and OTHER SECTIONS.

HYDRAULIC MACHINES for RIVETING, FLANGING, CHANNEL CUTTING, MANHOLE PUNCHING, FRAME SETTING, HYDRAULIC PUMPS, ACCUMULATORS, Etc. Etc.

Codes Used: Lieber's, A B C (5th Ed.), Marconi & Engineering. Telegraphic Address: "PLANER, GLASGOW."

ASSOCIATED BRITISH MACHINE

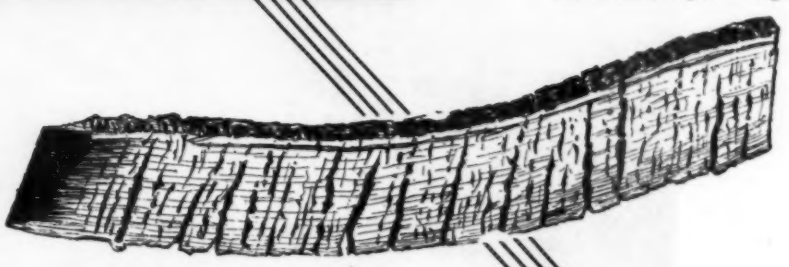
17. GROSVENOR GARDENS

MANCHESTER - LEEDS - GLASGOW - BIRMINGHAM

BUTLER

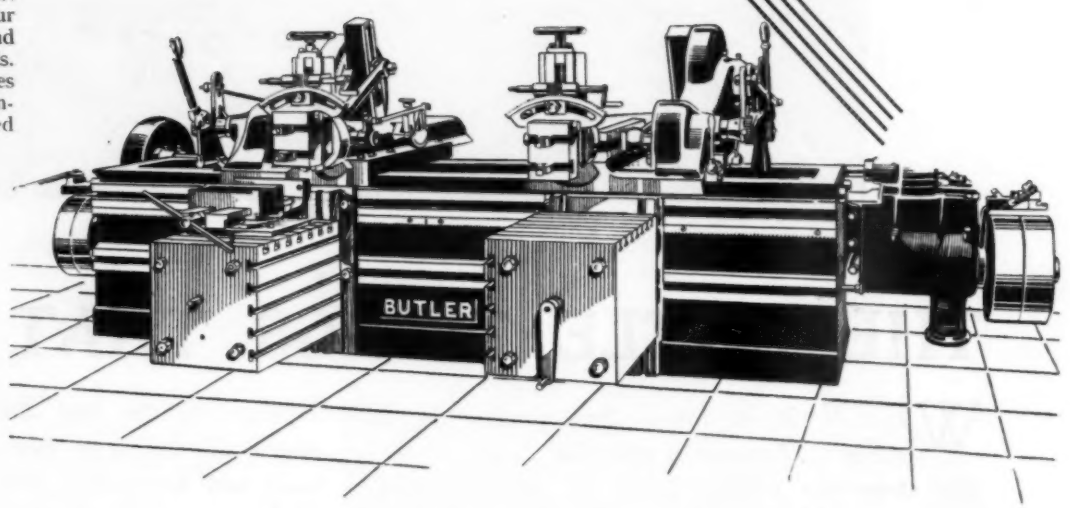
THE CUT.

The illustration shows, full size, a typical chip from the machine. This cut was $\frac{5}{8}$" deep × $\frac{1}{4}$" feed in mild steel, metal being removed at the rate of 10·3 cub. inches, or 3 lbs. weight, per minute.



THE MACHINE

is the "BUTLER" 24/26" stroke Double Traverse Head Shaper. These machines are built in four sizes:—12/14", 18/20", 24/26" and 30/32", with one or two heads. They embody numerous features of operation and control to maintain consistently an unequalled output of accurate work.

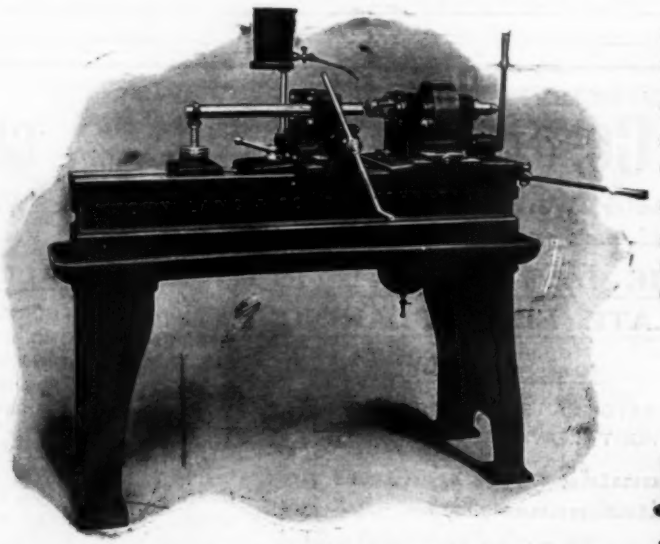


THE BUTLER MACHINE TOOL Co., Ltd.,

VICTORIA IRONWORKS, HALIFAX, England.

CENTRING MACHINES

ESSENTIAL IN THE TURNING SHOP.



[Centring Machine to take from $\frac{1}{2}$in. to 4in. diameter.

We make these machines in four sizes to take up to 4", 6", 8" and 12" diameter.

The two smaller machines are made with two spindles; one for facing preparatory to centring, the other for centring and counterboring.

The two larger machines are made with three spindles; one for facing, one for centring and the third for counterboring, thus enabling suitable centres to be made in large diameter work.

SEND FOR PARTICULARS.

JOHN LANG & SONS LTD.

JOHNSTONE, nr. GLASGOW.

BRITISH BUILT MACHINES

TOOL MAKERS LIMITED

LONDON, S.W.1.

NEWCASTLE - PARIS - BRUSSELS - CALCUTTA

Ward

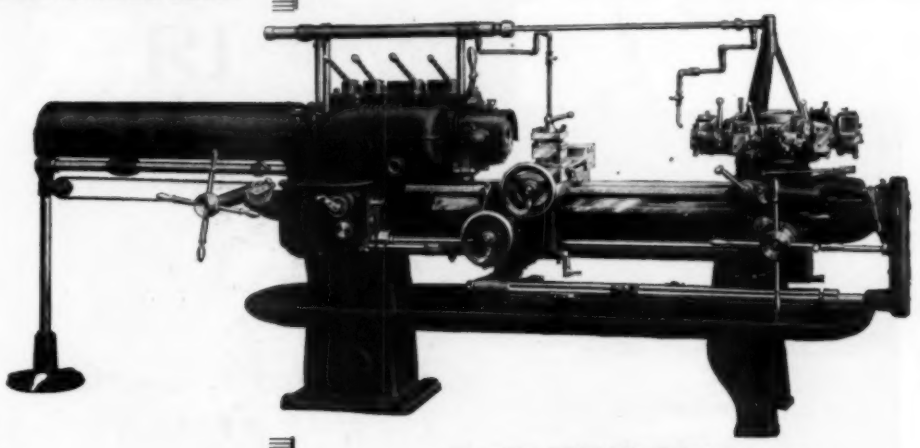
CAPSTAN LATHES
TURRET LATHES
BROACHING MACHINES

EARLY DELIVERY can be given of all types.

Full particulars on request.

HIGHLY PRODUCTIVE AND ECONOMICAL ON BOTH CHUCK AND BAR WORK.

Production times on your work will be submitted on receipt of samples or drawings.



2in. × 30in. HEXAGON TURRET LATHE.

H. W. WARD & Co., Ltd.,
Selly Oak - - BIRMINGHAM.

RICHARDS

Vertical Boring and Turning Mills, Horizontal Surfacing Boring, Milling, Drilling and Tapping Machines, Side Planers and Slot Drilling Machines *are all that modern machines should be.*

SPEED with ACCURACY

is a characteristic feature of Richards Vertical Boring and Turning Mills. Their accuracy enables the machines adequately to meet the exacting demands of precision engineering, whilst their speed of output renders their installation essential when maximum production is required. That is why the 6ft. machine shown is installed in the Finnieston, Glasgow, works of Messrs. Harland & Wolff, Ltd., by whose courtesy this photograph is reproduced

GEORGE RICHARDS & Co. Ld.
BROADHEATH, near MANCHESTER.

BRITISH BUILT MACHINES

TRANSFORMERS

Transformers are shipped in oil ready for immediate service.

TRANSFORMERS should be the most reliable and robust of all electrical apparatus, but economy should not be put before safety in their manufacture. In the construction of Parsons' Transformers no consideration is allowed to interfere with the provision of every possible safeguard; the design, workmanship and selection of material are such as to produce a thoroughly sound piece of apparatus.

C.A. PARSONS

& COMPANY LTD

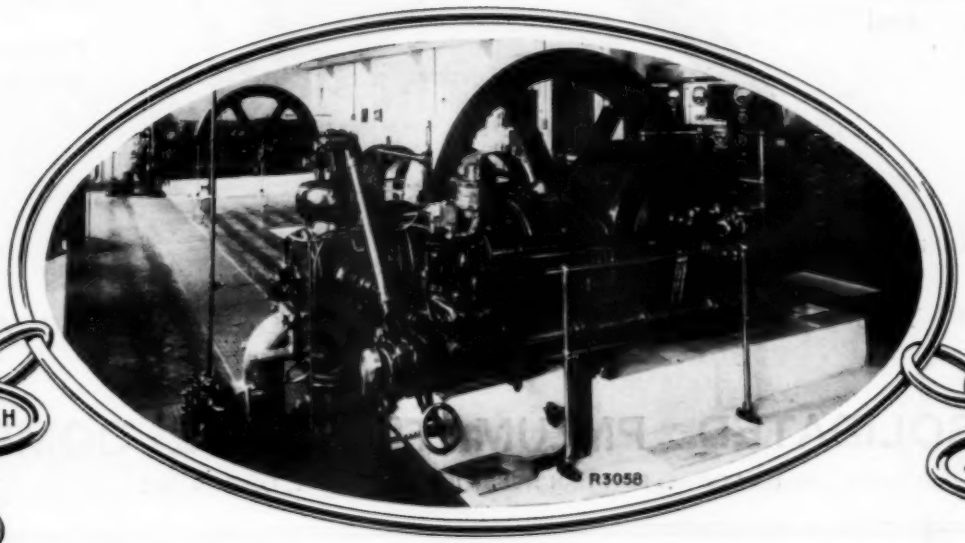
Head Office:
HEATON WORKS,
NEWCASTLE-ON-TYNE.

London Office:
56, VICTORIA STREET,
LONDON, S.W.1.

TRADE MARK

I.P.&—No. 154—P. 4805

G.P.O. Repeater Stations and Ruston Oil Engines.



ALDEBURGH
BIRMINGHAM
CANTERBURY
CATTERICK
DERBY
GLOUCESTER
GUILDFORD
JEDBURGH
MARKSTEY
MARLBOROUGH
NEWCASTLE
NEWPORT
TAUNTON

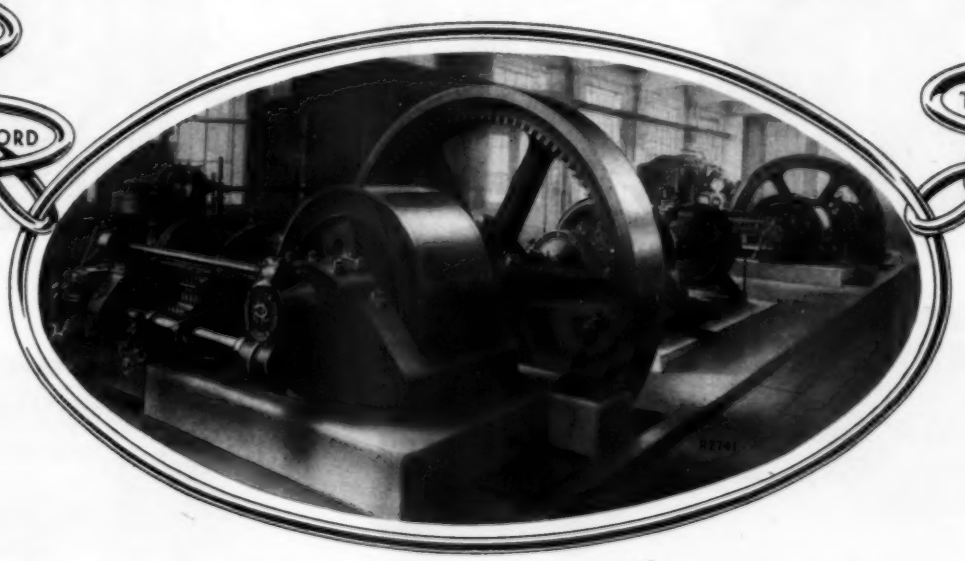
TOP and bottom illustrations show the generating plant at the Fenny Stratford and Taplow Telephone Repeater Stations.

IN each case the current is generated with two sets of Ruston Crude Oil Engines each capable of developing 84 B.H.P.

THESE stations form part of a chain of 15 stations here mentioned where similar Ruston Oil Engines are in operation.

THE adoption of Ruston Engines by this important Government Dept.—responsible for the efficient maintenance of public services—is a sure indication of the Economy and Reliability of the small independent plant and the

Superiority of Ruston Oil Engines.



RUSTON & HORNSBY LTD. LINCOLN

LONDON: Imperial House, 15-17-19, Kingsway, W.C.2.

G

LITTLE GIANT PORTABLE PNEUMATIC DRILLS.

Tel. Address:
CAULKING, PIOCY,
LONDON.

Tel. No.:
GERRARD 9215.

The Little Giant Pneumatic Drill has firmly established its position in the engineering world as the premier machine. To-day it stands unrivalled in design, efficiency, and reliability.

Made in sizes and types to suit all requirements. Capacities from ¼ in. to 3 in. metal.

Reversible and non-reversible.

Pneumatic Wood-boring machines also supplied.

For
Drilling,
Reaming,
Tube-expanding.
Tube-cutting.

WORKS:
FRASERBURGH, SCOTLAND.

BRANCHES
ALL OVER THE WORLD.

LET US HELP YOU IN YOUR DRILLING PROBLEMS—OUR EXPERTS ARE AT YOUR DISPOSAL.

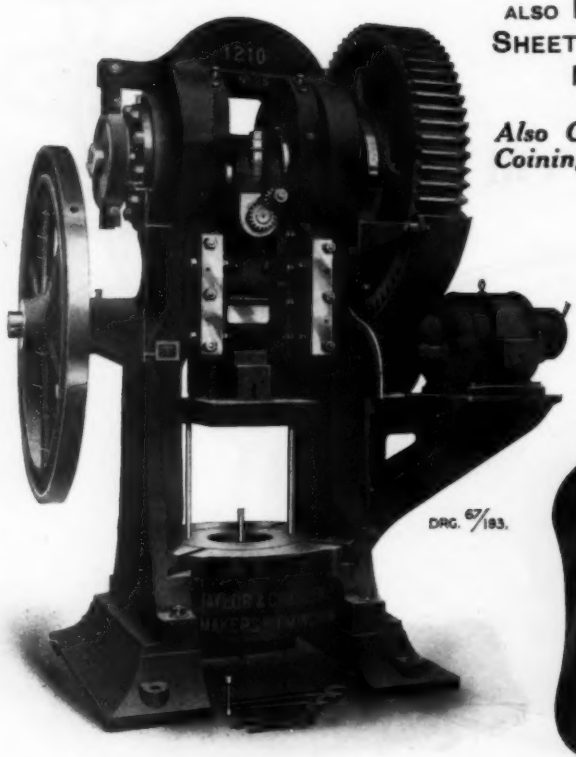
THE CONSOLIDATED PNEUMATIC TOOL COMPANY, LTD.,

Head Offices: EGYPTIAN HOUSE, 170, PICCADILLY, LONDON, W.1.

TAYLOR & CHALLEN PRESSES

ALSO LATHES & SHEARS FOR SHEET METAL WORK & SEAMLESS METAL HOLLOWWARE.

Also Complete Plants for Minting, Coining and Cartridge Manufacture.

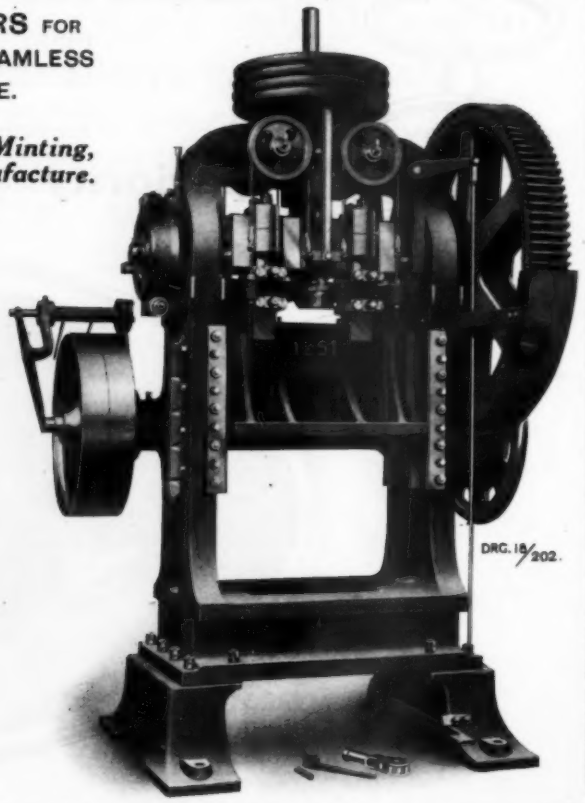


DRG. 67/183.

Press 1210 is direct Motor Driven and cuts out Blanks, bends and presses metal generally up to its limit of 250 tons pressure on bottom of stroke.

STEP IRON PRODUCED IN PRESS No. 1210

MOTOR RADIATOR TRIMMED IN PRESS No. 1251.



DRG. 18/202.

Press 1251 has a 10" Stroke and Balanced Slide, and is specially suitable for Clipping and Piercing deep articles already raised or pressed. Limit 70 tons pressure on bottom centre.

TELEGRAMS: DERWENT BIRMINGHAM
TELEPHONE: CENTRAL 376.
A.B.C. CODE 5th Edition.

TAYLOR & CHALLEN LTD
ENGINEERS.
DERWENT WORKS, CONSTITUTION HILL, BIRMINGHAM

LONDON OFFICE:
ST. STEPHENS HOUSE,
VICTORIA EMBANKMENT, S.W.1.
TELEPHONE VICTORIA 3513

GREATEST EFFICIENCY AT LOWEST COST

The Albion 2-Tonner

THE more vehicles you run, the more urgent is the need for the greatest efficiency at the lowest cost. With one vehicle alone, a saving of only 1d. per mile in the running costs may mean a difference of £80 per year, or more than £1,000 during the average life of a first-class vehicle.

It is because Albions have *proved* under rigid tests their immense superiority over other makes, in reliable service and low running costs, that some of the largest transport users have decided to standardize their fleets with Albions.

Wherever the Albion 2-tonner is used, it is acknowledged as the most profitable investment of all vehicles of this load capacity.

Chassis Price £495 *(Ex-Works, Glasgow)*

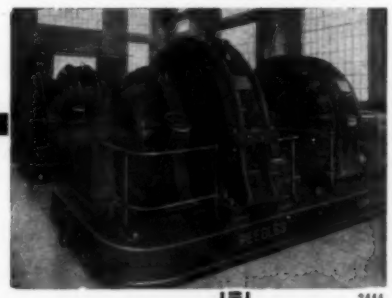
Write to-day for detailed particulars.

War Office Subsidy Scheme.

Write for particulars of the £40 per annum Subsidy Scheme for which both 30-cwt. and 40-cwt. Subsidy type Albions are eligible.

The photograph represents a 2-ton Lorry, one of a fleet supplied to the London, Midland & Scottish Railway.

Albion
COMMERCIAL MOTORS
ALBION MOTOR CAR CO., LTD.
SCOTSTOUN, GLASGOW.
London: BANK BUILDINGS, 20 KINGSWAY, W.C.2
Also at MANCHESTER, LEEDS, SHEFFIELD, BIRMINGHAM & BRISTOL.



One 2000 K.W. and Two 1250 K.W. Motor Converters at Johannesburg.

Electrical Machinery

Alternators *Dynamos*
A.C. & D.C. Motors
Synchronous Motors
Synchronous Induction Motors
Frequency Changers
Motor Generators
Rotary Converters *Motor Converters*

PEEBLES

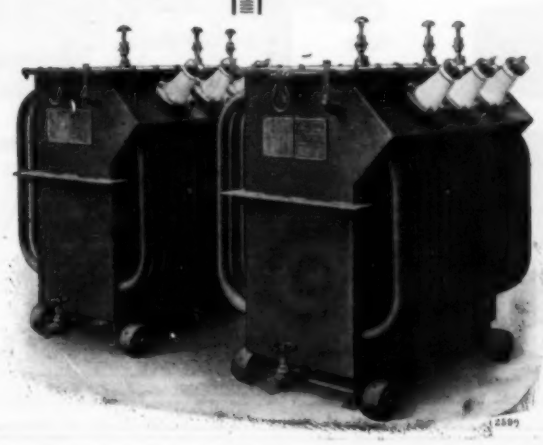
BRUCE PEEBLES & CO., LTD.
ENGINEERS **EDINBURGH.**

TELEGRAMS: *"Peebles, Edinburgh."*
TELEPHONES: *Granton* 461-2-3.

— and — Transformers

ALL SIZES ALL TYPES

Two 100 K.V.A. 22,000/415 volts 3 phase 50 cycles O.I.S.C. Indoor type Transformers for Ayrshire Electricity Board.



SAVE COAL

BY USING "MARSHALL" LOCOMOBILES

The most ECONOMICAL STEAM ENGINES in the world.

Fuel Consumption 1·39 lbs. per B.H.P. per hour with Coal of 11,500 B.T. Units, Calorific value

Apply for Illustrated Catalogue. :: **MARSHALL, SONS & COMPANY, Ltd., Engineers, GAINSBOROUGH.** :: *Mention "The Engineer."* No. 1.

END STAND No. 240 R.A.S.E. SHOW, NEWPORT, MON.

The DRILLS FOR AWKWARD JOBS !

Have you ever watched at the Tool-stores grille in your shop ? Here is a veteran machinist asking for a 2″ drill—he's on that difficult job on the big Asquith. A few minutes later he's back again—drill no good—won't stand the racket —try another—and so it goes on. For the tough jobs, the long jobs, the awkward jobs, see that your stores-man has a selected stock of Firth "Speedicut" Drills handy.

The following particulars are typical of Firth "Speedicut" endurance:

Dia. of 'Speedicut' Drill.	Revolutions per Minute.	Cut per inch.	Penetration Inches per Minute.
11/16"	385	35	11
1 1/16"	325	35	9·3
1"	315	35	9
1¼"	245	35	7
1½"	200	35	5·7
2"	160	35	4·57

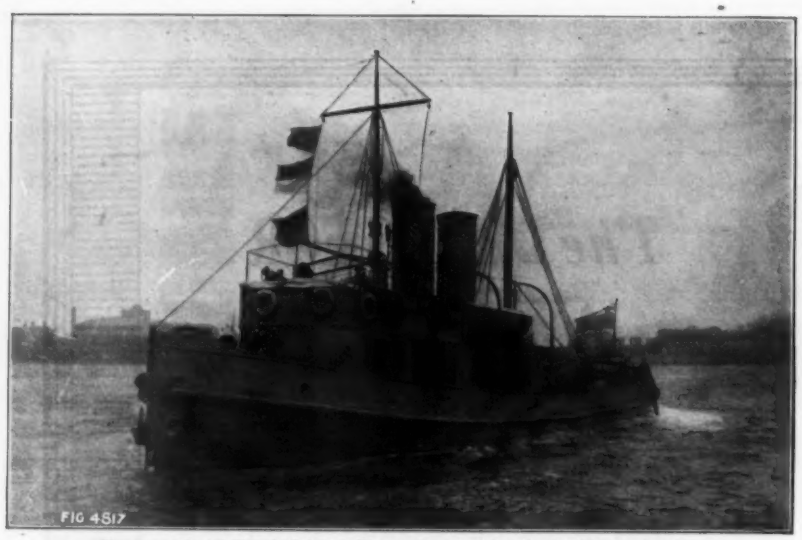
Obtained on ·30% Carbon Machinery Steel, 2" thick, 50 holes drilled between grindings.

May we send you our Drill literature, or investigate for you any cutting problems?

THOS. FIRTH & SONS, LTD.
SHEFFIELD.

152/1/63

FIRTH
SPEEDICUT TWIST DRILLS



Merryweathers' Fire & Salvage Tug constructed for the British Admiralty.

MERRYWEATHERS'
FIRE & SALVAGE BOATS

for SEA, RIVER or HARBOUR WORK.

Designed and built to suit special requirements.

PORTABLE SALVAGE PLANT & LIGHT BOILERS

PUMPS

Driven by STEAM, PETROL ENGINES or ELECTRICITY.

SPECIAL HOSE for SALVAGE WORK

Write for Illustrated Catalogue 25 C.E.R.

MERRYWEATHER & SONS, LTD.

(Now incorporating SHAND, MASON & CO.)

GREENWICH, S.E. 10, LONDON.

HERCULES

HOSE REPAIRERS,

COUPLINGS, Etc.

FOR ALL CLASSES OF HOSE
(INCLUDING PNEUMATIC & WELDING)
(Patent)

SIMPLY HAMMER IT!

NO WIRE BINDING, CLIPS OR BOTHER.

A quick and efficient method of repairing or coupling hose. No special tool needed. The ends of the hose are slipped on to the fitting and the claw-grips hammered down.

A USEFUL EXAMPLE.

½in Coupling

For coupling together lengths of half-inch air hose. Similar to our Repairers (above) but can be disconnected at will.

Send for full List.

NEWTON SALES CO., LTD.,
(Quote Advert. No. 445r.)
Charterhouse Chambers, London, E.C.1.

EAST FERRY ROAD ENGINEERING WORKS CO., LTD.,
MILLWALL, LONDON, E.

Hydraulic & General Engineers & Ironfounders

See our illustrated advert. in last and next week's issues

Telegrams: Hydrostatic, London.

Clerihew Kennedy & Co. KILMARNOCK

See next week's issue for
"Glenfield" Water Works Appliances

GLENFIELD & KENNEDY LTD.

SQUARE
PALCO
PLAITED PACKING

has just the right amount of graphite grease lubricant that Centrifugal Pumps require.

The shaft of a Centrifugal Pump runs at high speed on a concentrated packing surface, and under such conditions packings that harden score the shaft and quickly destroy the packing.

Let us send you working sample to test under your own conditions. State size wanted.

W. F. JOHNSON & CO.,
Agents,
14 & 16, Farringdon Road,
LONDON, E.C.

MACHINE CUT GEARS.

CHANGE WHEELS AND STANDS.
All Sizes 14 d.p. to 4 d.p. Accurately Cut by New Process. Very Low Prices. Ask for List.

SPUR GEARS.
Standard patterns for all sizes, oval or + section arms, to 2in. pitch, face to suit, 5ft. diameter.

MITRES AND BEVELS.
To 2in. pitch and 24in. dia. Larger sizes to order.

PAPER & RAW HIDE PINIONS.

SKEW AND WORM GEARS.

CLEAN CASTINGS. Spur Gear Blanks
from any of the above patterns. Balance Wheels made up to suit customer, and Castings only supplied if required.

General Machine Castings made to Customers Patterns. Low Prices for Planing, Boring, Turning, Screwcutting.

Send your Enquiries:—

Greenwood's Standard Gear Cutting Co., Ltd.,
NEW BOND STREET, HALIFAX.
Telephone: 1212. Telegrams: "Gears."

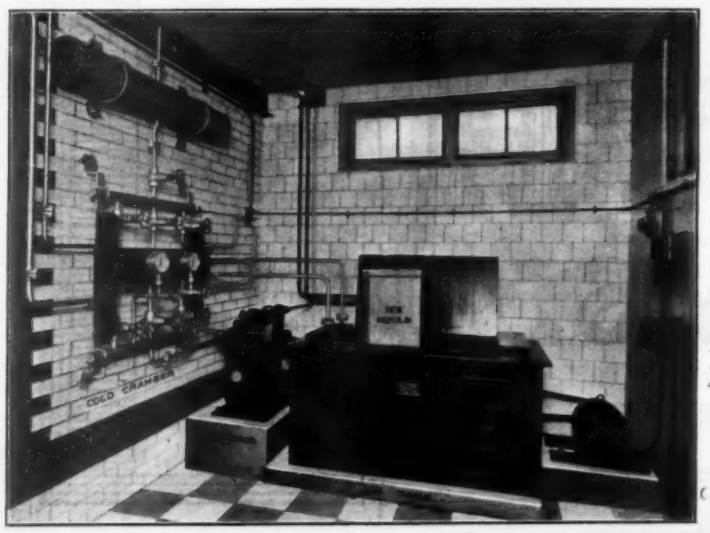
"BUFFALO" INJECTORS

Operated Entirely by One Handle.

FOR HOT WATER.

Telegrams: TEMPERATURE, LONDON.

Green & Boulding LIMITED, 162a, Dalston Lane, LONDON, E.8.



REFRIGERATION

FOR

COLD STORES & ICE MAKING

INSTAL

The LATONA-LEBRUN FLOODED SYSTEM

WHICH SHOWS **15%** SAVING OVER ANY OTHER METHOD.

WE SUPPLY THE TRADE WITH
COMPRESSORS, CONDENSERS, COILS, VALVES, PRESSURE GAUGES & SPECIAL HIGH-PRESSURE FITTINGS.

THE LATONA ENG. CO. LTD.

LATONA ROAD, PECKHAM, LONDON, S.E.15.

TELEPHONE—NEW CROSS 2002/3003.

A good investment

No. 2—*Watch this space next week but write now for illustrated literature.*

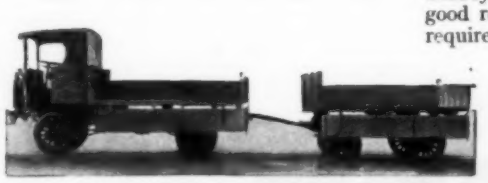
F W D ENGLAND

You may consider this an unusual vehicle, but it's a first-class investment like all our standard Four-Wheel-Drive Lorries.

It's a fire engine, fitted with Foamite tank, pumps, hose reel, etc., running on rail. Supplied to a large oil company for fire fighting at their refineries. Satisfactory performance quickly led to a repeat order.

Four Wheel Drive is essential on a vehicle of this type in order to get maximum adhesion on rail. Is this not equally important on lorries having to handle tonnage under varied road conditions?

We say "Yes," and that's why all our vehicles are four-wheel driven, with every ounce of energy developed by the engine properly distributed to give traction—front wheels as well as rear. There is no slipping of back wheels, therefore, on hills or muddy places, and when it's a question of moving tonnage over good roads, bad roads, or no roads, our F.W.D. will do the job required and without wasting time or money.



Send for illustrated price list, or call at our Works, Slough, Bucks, and see for yourself.

Four Wheel Drive ***always*** *better than two.*

FOUR WHEEL DRIVE LORRY CO., LTD.,

'Phone: Gerrard 8058-9

46, Charing Cross, Whitehall, London, S.W.1. 'Grams: "Britfordri, Westrand, London."

DIAGRAM MAP OF GREAT BRITAIN

SHOWING DISTRICTS SERVED BY THE BRITISH OXYGEN CO. Ltd.

OXYGEN

For the cutting and welding of metals

The British Oxygen Co., Ltd.

FOUNDED 1886.

ORIGINATORS OF THE SEAMLESS GAS CYLINDER INDUSTRY.

THE BRITISH OXYGEN COMPANY is the oldest and one of the most extensive oxygen producing and distributing organisations in the world. The history of the Company is the whole story of the birth and development of the Oxygen Industry, and is a record of steady expansion year by year. To-day the Company has factories in all important industrial centres of Great Britain, equipped with the most modern plant, and capable of producing over

4,000,000 cubic feet of OXYGEN DAILY.

THE BRITISH OXYGEN COMPANY also manufacture and supply in cylinders HYDROGEN, NITROGEN, CARBONIC ACID GAS, NITROUS OXIDE, ARGON and OTHER GASES.

The Company are manufacturers of:

PLANT for the production of OXYGEN (in liquid or gaseous state), HYDROGEN and other gases, GAS COMPRESSORS, etc.
They also specialise in the manufacture of OXYGEN METAL-CUTTING APPARATUS, OXY-ACETYLENE, OXY-HYDROGEN, and OXY-COAL GAS WELDING BLOWPIPES, HIGH-PRESSURE GAS REGULATORS, and a large variety of HIGH-PRESSURE GAS APPARATUS.

For catalogues and full Particulars apply to any of the Company's works or to the Head Office:

Angel Road, Edmonton, N. 18.

London Showrooms: 69, HORSEFERRY ROAD, WESTMINSTER, LONDON, S.W. 1.

Also at CALCUTTA and BOMBAY, and at SYDNEY, N.S.W.

WELLS' NEW MODEL SPRAYING PISTOL.

UP-TO-DATE POWER PAINTING,

For Oil and Lead Paints, Varnishes, Enamels, Cellulose, &c., &c.

SIMPLICITY AND EFFICIENCY GUARANTEED.
PORTABLE & STATIONARY PLANT SUPPLIED.

WASTE OIL FILTERS

YOUR DIRTIED OIL FILTERED AND RENDERED FIT FOR USE OVER AND OVER AGAIN.

Made in Various Sizes and Special Plant furnished to meet all requirements.

"UNBREAKABLE" OIL LAMPS.

No. 20 Moulders' Lamp.

No. 18 Kettle Torch.

No. 18a Trench Lamp.

No. 1 Oil Feeder.

No. 4 Hand Lamp.

No. 5 Torch Lamp.

A. C. Wells & Co., Ltd., 101, Midland Road, St. Pancras, LONDON, N.W.1.
Works: Carnarvon St., MANCHESTER

Is this to be Your Lucky Year? Yes!

IF YOU **FIT** AND **REMEMBER** TO FIT

B.S.I.G.

MALLEABLE FITTINGS

AND

B.S. TUBES.

DON'T FORGET EVERY B.S.I.G. FITTING IS TESTED TO 300 lbs. PER SQ. IN.

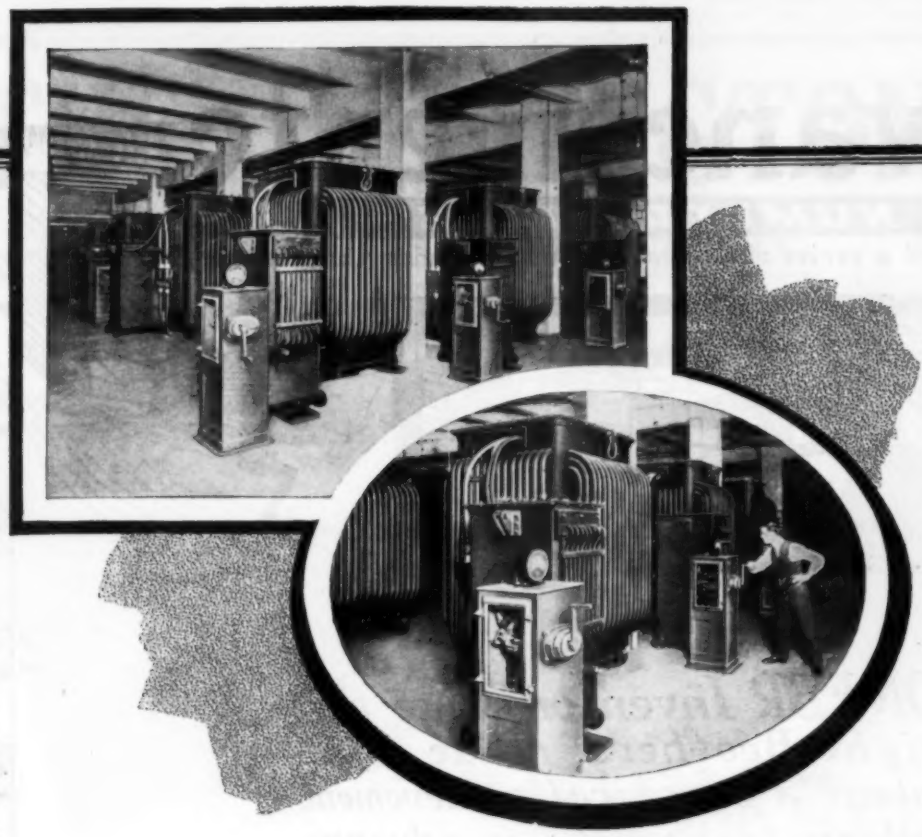
YOUR LOCAL MERCHANT CAN SUPPLY.

If your Local Merchant cannot supply your requirements, write to:

NORMAN PEARSON & CO., LD.

CROWN WORKS, LOTS ROAD, S.W. 10,

for the name of the nearest Stockist.



This is an example of the steady reliability and continuous service given by just the ordinary BERRY single phase, oil immersed, self cooled, standard pattern transformer.

A 20,000 K.V.A. group of such transformers is here shewn. They are installed in an underground substation, right in the heart of a busy industrial centre, and operating on a three-phase supply. Each main transformer is equipped with its own BERRY standard pressure Regulator.

Repeat orders for such installations are constantly being received, testifying to the satisfactory service given by the millions of horse-power of BERRY transformers in use all over the World.

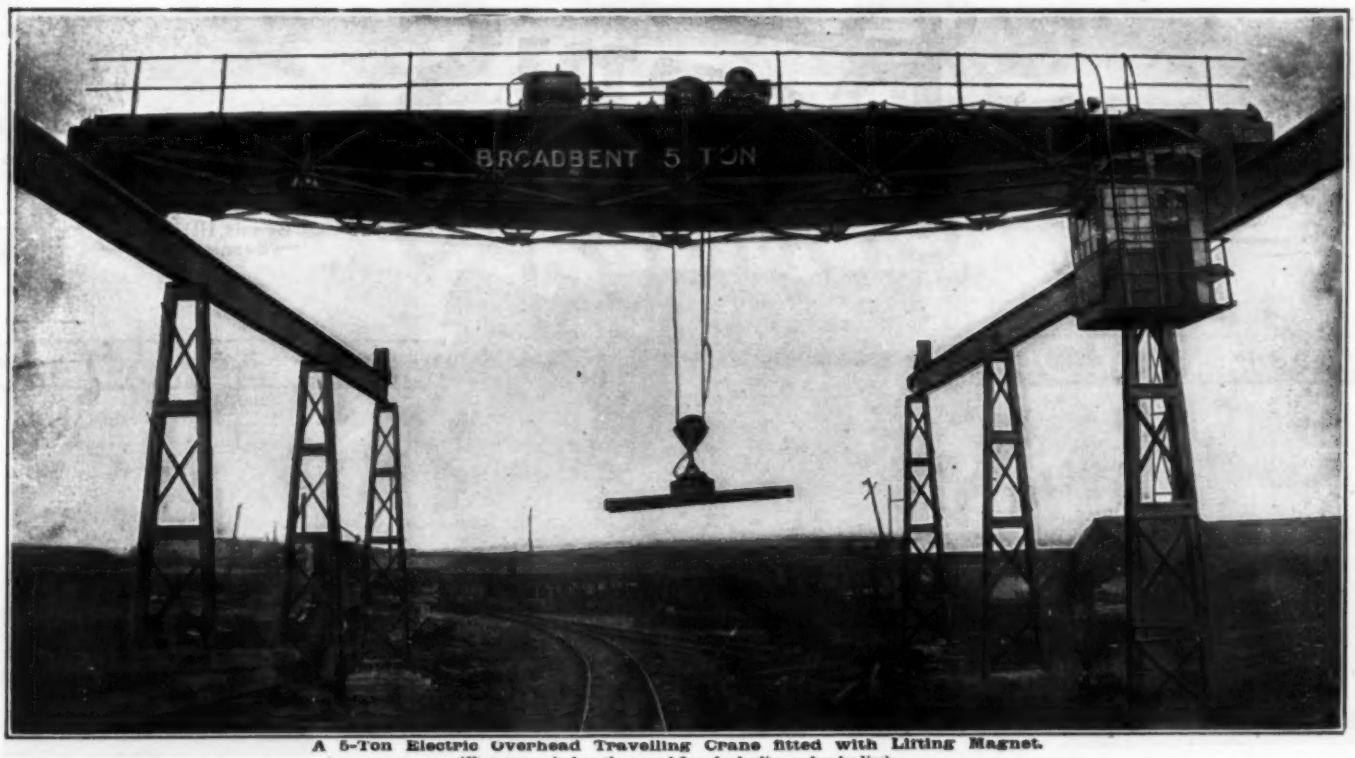
This is only to be expected in view of the fact that their construction and design are based on 30 years' continuous and ever-widening experience.

The
BRITISH ELECTRIC TRANSFORMER Co., LTD.
HAYES, MIDDLESEX, ENGLAND.

"Broadbent"

ELECTRIC CRANES

Supplied to most of the Leading Firms throughout the Country.



A 5-Ton Electric Overhead Travelling Crane fitted with Lifting Magnet.
(No men required on the ground floor for loading and unloading).

CAPSTANS **Thomas Broadbent & Sons, Limited,** **WINCHES**
HUDDERSFIELD.

D

Advancements

NUMBER FIVE

(This is the fifth of a series of six announcements under this heading)

PIONEER Inventors, like the Wright Brothers, made the Aeroplane a practical achievement for modern transport - an advance which even yet is in its infancy -

The Aeroplane has given wings to transport

"BENNIS" Methods of transporting Coal from canal or rail, direct to the boiler hoppers have likewise added speed and efficiency to Steam Production and at the same time cheapened its cost

THE pioneer inventions of Ed. Bennis & Co Ltd. have led the way to the modern Boiler House Practice - mechanical stoking and the rapid transport and removal of Coal and Ash

ED. BennIS & Co., Ltd.,
LITTLE HULTON · · BOLTON

London Office:-
28 Victoria St.,
Westminster,
S.W.1

TELEPHONES:-
Farnworth 13
Victoria 627
TELEGRAMS:-
"Bennis, Little Hulton"
"Bennis, London"

"Bennis in the Boiler House —

— means more Steam at less cost!"

THE DARLINGTON FORGE

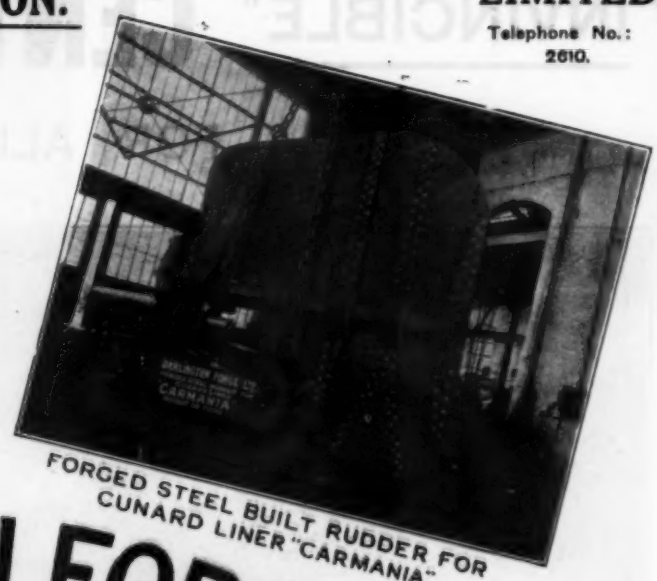
Telegrams:
FORGE, DARLINGTON.

DARLINGTON.

LIMITED.

Telephone No.:
2610.

CAST STEEL RUDDER FOR CUNARD LINER "AQUITANIA"



FORGED STEEL BUILT RUDDER FOR CUNARD LINER "CARMANIA."

STEEL AND IRON FORGINGS.

UP TO ANY SIZE OR WEIGHT.

"DARLINGTON" FORGE BRONZE PROPELLORS UP TO 24 FT. DIAM.

STEEL, BRONZE & GUNMETAL CASTINGS.

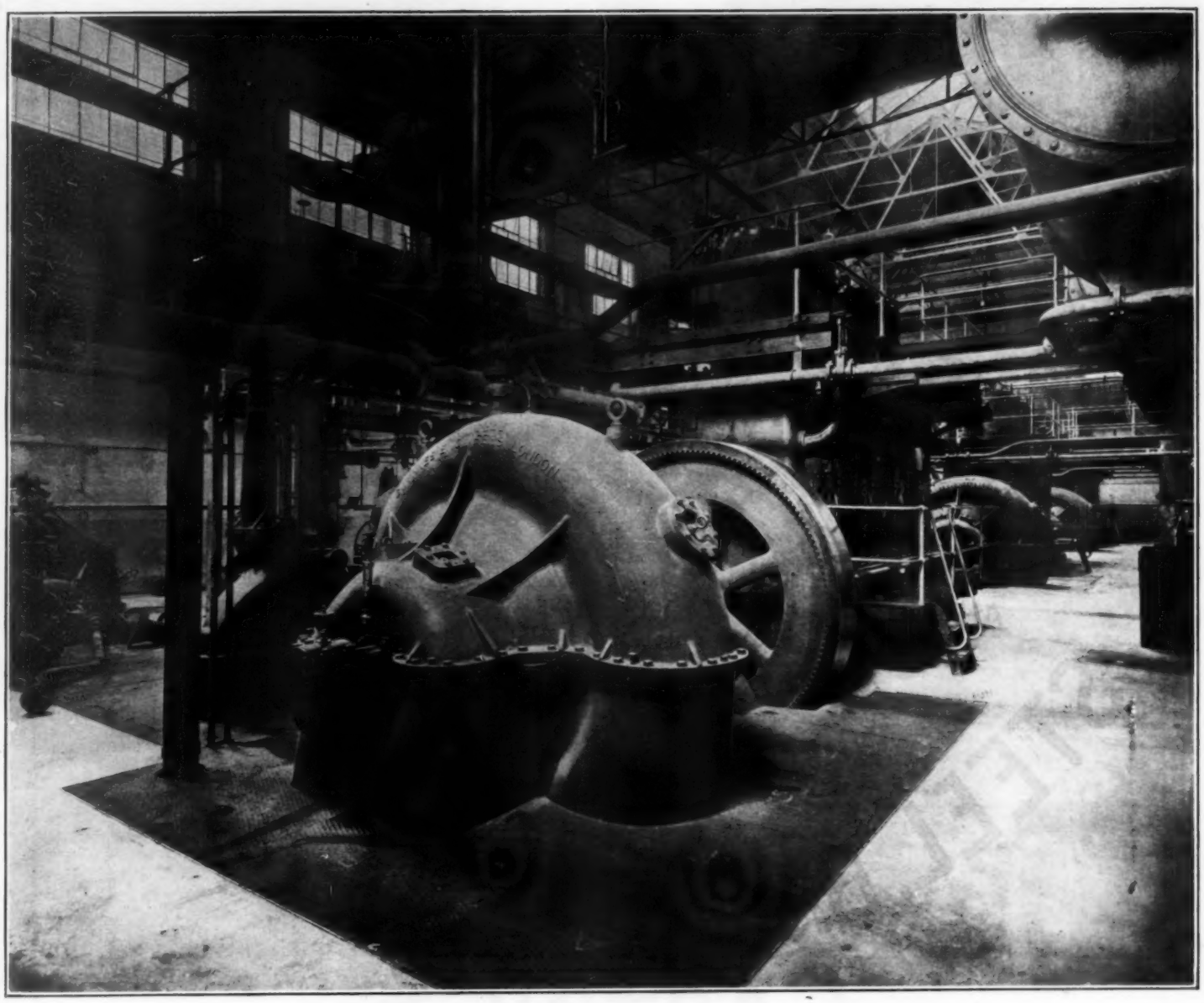
FORGED STEEL RUDDER STOCK "S. S OLYMPIC."

DIESEL ENGINE CRANKSHAFT 18½" DIAM 42-7½ LONG FINISHED WEIGHT 50 TONS

GWYNNES

"INVINCIBLE" CENTRIFUGAL PUMPS

FOR ALL SERVICES.



FIVE PUMPING SETS SUPPLIED TO THE
LONDON COUNTY COUNCIL.

1000 TONS OF WATER PER MINUTE.

ENGINES BY THE PREMIER GAS ENGINE CO., LTD.

GWYNNES PUMPS LTD.

Late **GWYNNES ENGINEERING CO., Ltd.,**

HAMMERSMITH, LONDON, W. 6, & Hammersmith Works, LINCOLN.

Telegrams: "GWYNNE, LONDON." Codes: Bentley's, ABC 5th Edition, Western Union, 5-Letter Edition. Telephones: RIVERSIDE 1910 (4 lines).

"PREMIER" INSTALLATION AT THE WORKS OF THE HOFFMANN MANUFACTURING CO., CHELMSFORD.

The reproduction is of two 500 B.H.P. "Premier" four-cylindered Gas Engines, part of the complete installation of six 500 B.H.P. engines all of which are direct coupled to D.C. generators.

PRIOR to the installation of the "Premier" Engines, power was generated by a steam engine and boilers, as well as gas engines and Diesel Oil Engines, consequently there was a considerable amount of data available for comparison with the "Premier" units.

The running costs of the complete "Premier" installation for a period of six months were carefully tabulated, and proved to be much lower than those of the previous combined power units. A distinct saving of upkeep and attendance costs was also recorded.

As an instance of the remarkable reliability of the "Premier" Gas Engine, the involuntary stoppages of the six engines during a run of 125,468 hours totalled only 12¾ hours, and during this run 28,567,044 units had been generated. One set had run 12,202 hours and the exhaust valves had not been ground in.

Each "Premier" Engine is direct-coupled to a dynamo of 360 K.W. normal output at 190 r.p.m. The generator shaft being connected directly to the boss of the engine fly-wheel, the combined unit is very compact and the floor space occupied is small in proportion to the load.

The full details with regard to the economical performance of this installation are contained in a descriptive leaflet No. 2155, which will be sent on application.

PREMIER GAS ENGINES ARE BUILT IN VARIOUS SIZES FROM 275 to 1000 B.H.P.
PREMIER HEAVY-OIL ENGINES ARE BUILT IN VARIOUS SIZES FROM 300 to 1000 B.H.P.

THE PREMIER GAS ENGINE CO., LTD.

SANDIACRE, *near* NOTTINGHAM, ENGLAND.

TELEGRAMS: PREMIER, SANDIACRE

LONDON OFFICE: 139-141, QUEEN VICTORIA STREET, E.C. 4.

Branches and Agencies in all Principal Centres.

TELEPHONE: 39 SANDIACRE.

P 8

THE FALLACY OF YESTERDAY
THE PRACTICE OF TO-DAY

Iron ships would not float. Propelled wheels would not move a carriage. Heavier than air machines would not fly. The way of the pioneer is hard and his heart has to be as strong as his courage.

Progress has ever to fight established custom and benefits have almost invariably been forced upon the world against its will.

The thought of being ahead of our time has never impeded our progress, but it has perforce developed our aggressiveness or we should have fallen by the way.

When we fitted ball and roller bearings as standard to Parkinson Motors, we were told they would never stand up to the job. To-day it has become common practice, and we fit roller bearings to 1000 H.P. machines.

When we invented the Parkinson method of impregnation, we were told the insulation would break down, yet these machines have been working in most atrocious conditions without the slightest sign of trouble.

When we said that inactive weight was not necessarily strength, we were considering first the quality of the materials and grade of castings. To-day, Research has shown that weight does not denote excellence, and the modern practice is to judge electrical performance not by weight, but by quality.

There is not a portion of the Parkinson Motor which has not been deliberately planned to be better than the previously made. Innovations there are, but they're sound in principle, sound in practice, and we say earnestly that any man may safely stake his professional reputation on Parkinson A.C. Motors.

F&A PARKINSON LTD

GUISELEY
LEEDS

BUY VALUE AND FORGET THE PRICE

BALDWINS

for Rails & Fishplates.

In Open-hearth Basic Steel Conductor Rails a Speciality

Approved Contractors to the leading British, Colonial, Indian and Foreign Railways.

Registered & Head Office :
BALDWINS LTD.
G.P.O. Box No. 25a, Baldwin House, Great Trinity Lane, London, E.C. 4
Telephone : Central 7926.
Telegrams : "Balwinas, Cannon, London."

London Office (Sales) :
G.P.O. Box 286, Baldwin House, 67-71, Queen Victoria St., E.C. 4
Telephone : Central 7926.
Telegrams : "Promptitude, Cent., London."

Works & Collieries Central Control Office :
45, Wind Street, Swansea.
Telephone : Swansea 4941.
Telegrams : "Baldwins, Swansea."

Monmouthshire Branch :
Pontrg Sheet & Galvanising Works, Pontrg, near Newport.
Telephone : Pontypool 6.
Telegrams : "Baldwins, Griffithstown."

Midland Branch :
Wilden Iron Works, nr. Stourport.
Telephone : Stourport 10.
Telegrams : Wilden, Stourport."

Birmingham District Office :
Baldwins Netherton Furnaces, Netherton, nr. Dudley.
Telephone : Dudley 2159.
Telegrams : "Baldwins, Netherton, Worcestershire."

Manchester Office :
223, Corn Exchange Buildings.
Telephone : Central 5007.
Telegrams : "Tinned," Manchester."

Liverpool Office :
Royal Liver Buildings.
Telephone : Bank 588.
Telegrams : "Baldwins, Liverpool."

Canada :
H. Russell & Sons, Ltd., Place d'Armes, Montreal
Cable : "Baldruss."

Australia :
R. Johnson, Clapham & Morris, Ltd., 28 & 30, O'Connell Street, Sydney
Cable : "Metallicus."

New Zealand :
A. G. Washer, Union Bank Chambers, Wellington, N.Z.
Cable : "Jacem."

South Africa :
Baldwins (South Africa) Ltd. P.O. Box 1189, Lozarso House, Main Street, Johannesburg.
Cable : "Promptitude, Johannesburg."

Denmark :
Borgersen & Co., Nørrevoldgade 16, Copenhagen
Cable : "Borgersen, Copenhagen."

Holland :
W. Van Houten & Zonen, P.O. Box 513, Baan 103, Rotterdam.
Cable : "Vanhouten, Rotterdam."

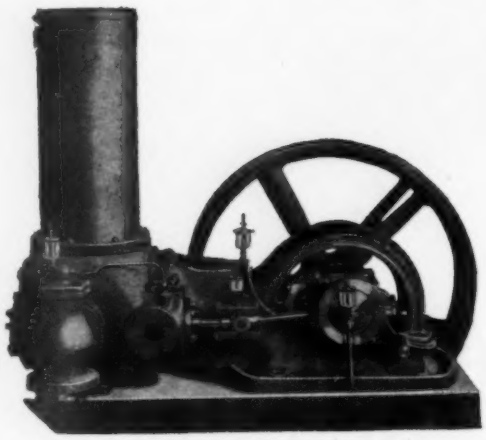
BALDWINS LTD.

B

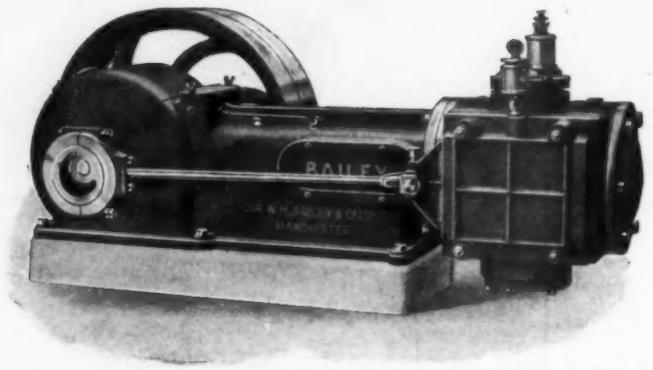
Bailey's

AIR COMPRESSORS

AND VACUUM PUMPS.



CLASS L.—TWO-STAGE AIR COMPRESSORS.
Mechanically Operated Inlet Valve. Only one Delivery Valve.
Great Saving in Power over any Single-stage Machines.



Class C.—THE KÖSTER "DRY" VACUUM PUMP with Slide Valve.
For the Highest Vacua. Totally enclosed, Belt Driven.

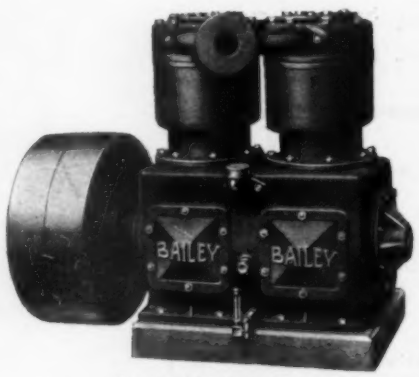


Fig. 5239—D.R. Type.
HIGH-SPEED VERTICAL COMPRESSORS
With One, Two and Three Cylinders,
in all sizes.

AIR-ON-WHEELS" ELECTRIC TYRE PUMP.
Inflating a 38" × 7" Giant Pneumatic Tyre.

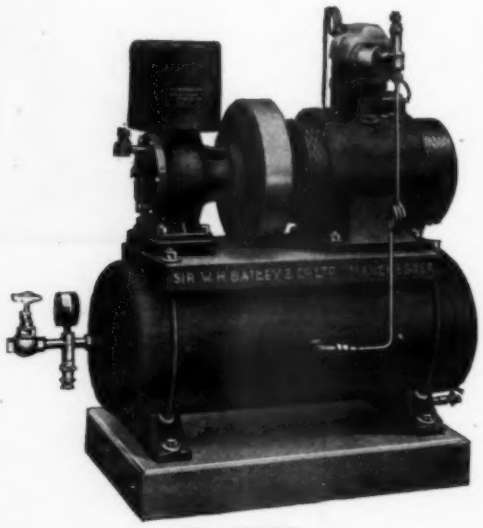
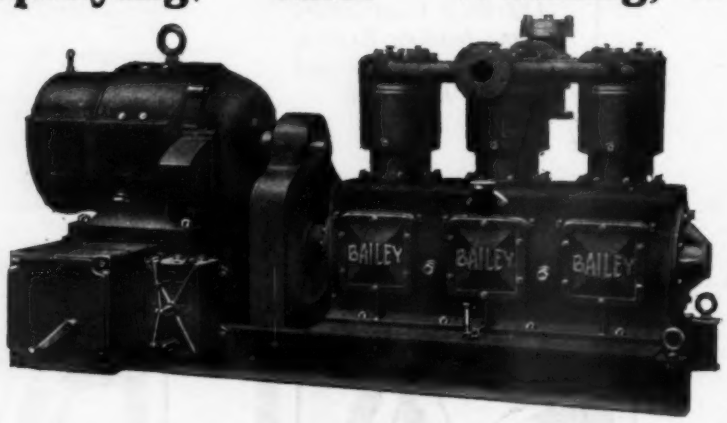


Fig. 5227 P.
ELECTRIC COMPRESSOR & RECEIVER
in all sizes.

Compressors for Garages, Motor Car Makers & Body Builders for Inflating Tyres, Paint Spraying, "Mist" Washing, &c.

Group of Fig. 5239 S.1
ELECTRICALLY-DRIVEN AIR COMPRESSORS.



MOTOR-DRIVEN T.R.S. TYPE.
Supplied to the Mersey Docks and Harbour Board, Liverpool.

Manufactured by

Sir W. H. Bailey & Co Ltd

ALBION WORKS, SALFORD, MANCHESTER.

Telegrams: "BEACON," MANCHESTER.
Tel. Nos. 2/28 & 2729 CENTRAL, MANCHESTER.

Codes:
A.B.C. 5th ED. & LIEBERS.

OIL PUMPS

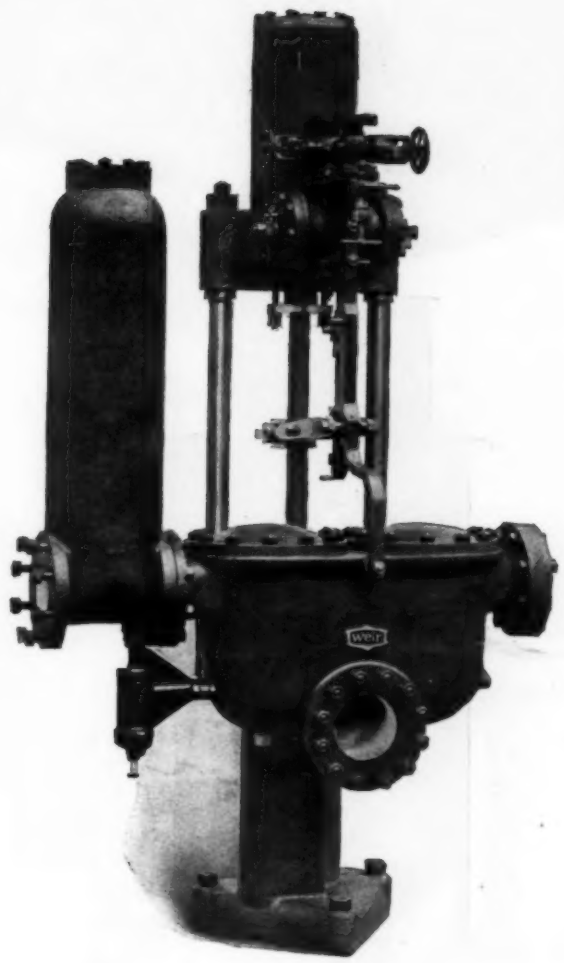
Specify "Weir Pumps" for Reliable Service.

The Weir Oil Pump is the product of a varied and extensive experience in dealing with Oil Fuel.

The oil pipe line stations of Burma and Persia are equipped with Weir Pumps, while thousands of Weir Oil Fuel Pumps are rendering efficient service in H.M. Navy, in the leading Foreign Navies, and in the Mercantile Marine.

These pumps are specially designed for the pumping of oils, from the most fluid to the most viscous; and they may be applied to any set of conditions as regards lengths of suction pipe and suction lift.

Consult us, without obligation, on your problems.



LONDON OFFICE:
78, Gracechurch Street, E.C. 3.

LIVERPOOL OFFICE:
312, Royal Liver Buildings, Pierhead.

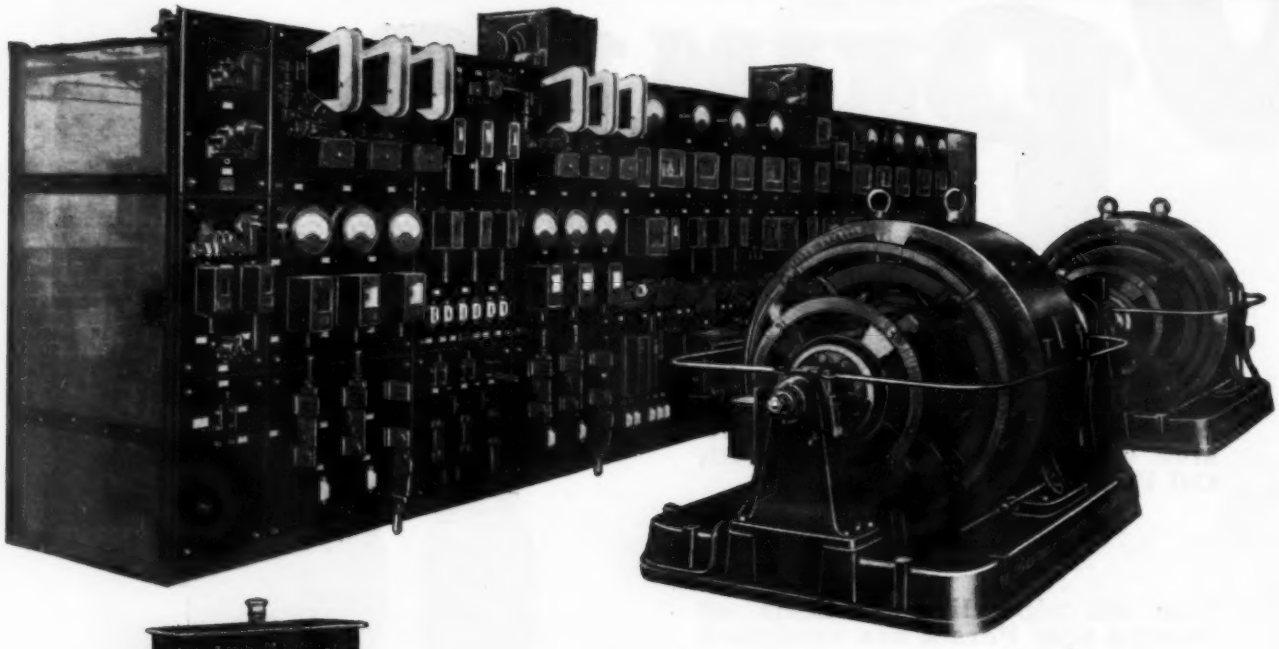
G. & J. WEIR LTD
CATHCART : GLASGOW

MANCHESTER OFFICE:
22, St. Mary's Gate.

NEWCASTLE OFFICE:
Bank Chambers, 26, Mosley Street.

E

Automatic Sub-stations



191,900 Kw

of automatic sub-station equipment has been supplied by this Company for power, lighting and traction services at home and abroad.

Many of the sub-stations included in the above figure have been in successful operation for a number of years and such equipments have been supplied for fully automatic, remote and supervisory control and for normal or inverted running.

The illustration shows the B.T.H. automatic sub-station equipment at Small Heath (Birmingham Corporation). This equipment is controlled from a manual sub-station at Bordesley by means of the supervisory control gear shown in the foreground.

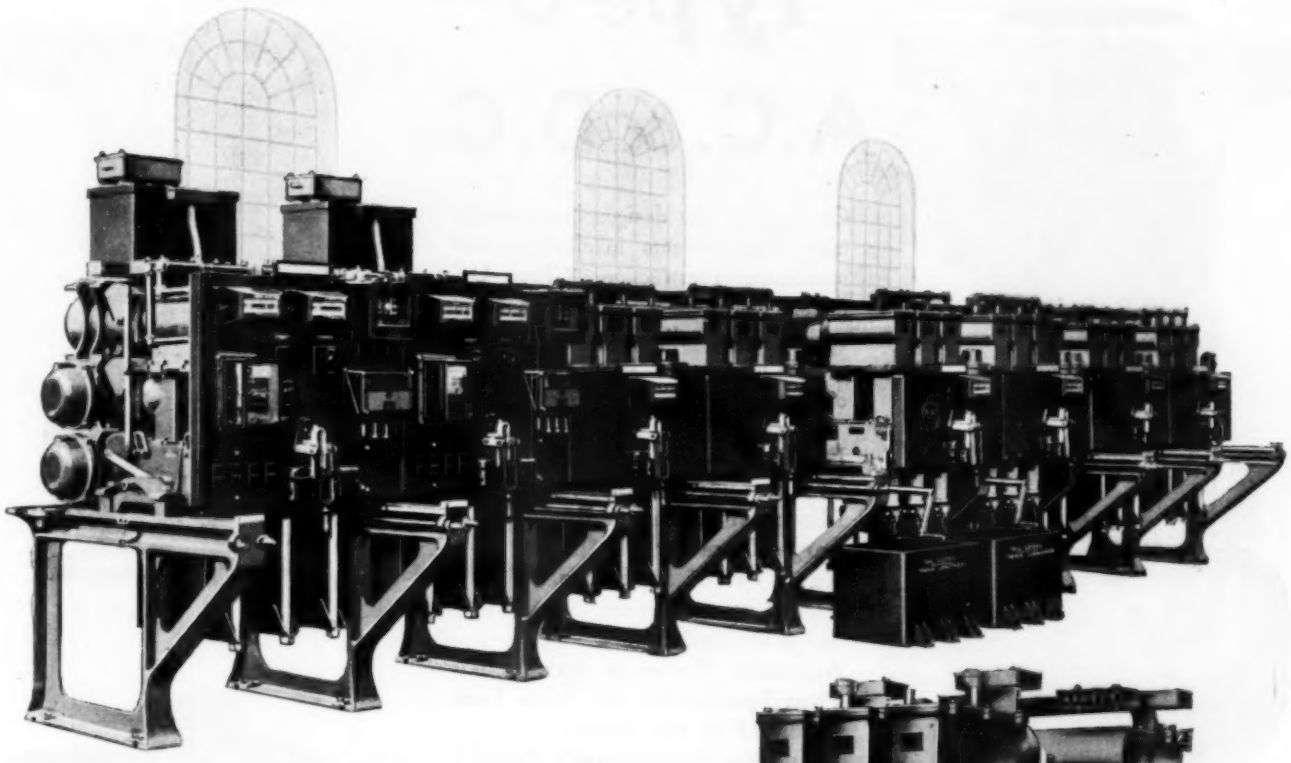
The British Thomson-Houston Co., Ltd.

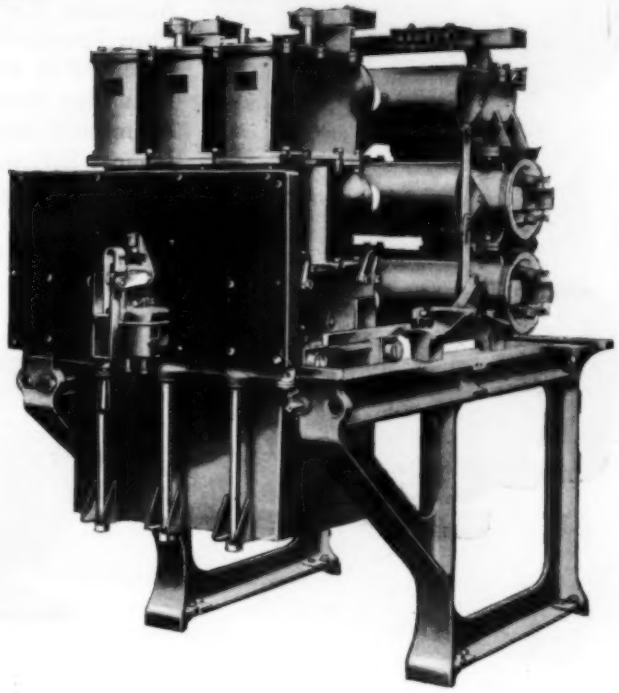
ELECTRICAL ENGINEERS AND MANUFACTURERS

Head Office: Rugby, England. London Office: "Crown House," Aldwych.

Works: Rugby, Birmingham, Willesden, Coventry and Chesterfield.

Compound Filled Switchgear





B.T.H. Compound-Filled Switchgear embodies many unique and important features, such as:—

Complete protection of all live parts, which is automatic on withdrawal of the circuit-breaker.

Steel clamps hold the circuit-breaker rigidly in position even under the most severe short-circuit stresses.

All live parts, except the oil-immersed circuit-breakers and transformers, are compound-filled before despatch.

Oil-throwing is positively prevented by efficient separating chambers and gas vents.

Potential transformer fuses may be changed whilst the circuit-breaker is under load.

Current transformers, being in oil-filled chambers, may be readily changed to obtain different ratios.

Current transformers are mounted on the oil circuit breaker-carriage and are isolated on the withdrawal of the latter.

Absolute reliability ensures continuous service.

The British Thomson-Houston Co., Ltd.

ELECTRICAL ENGINEERS AND MANUFACTURERS

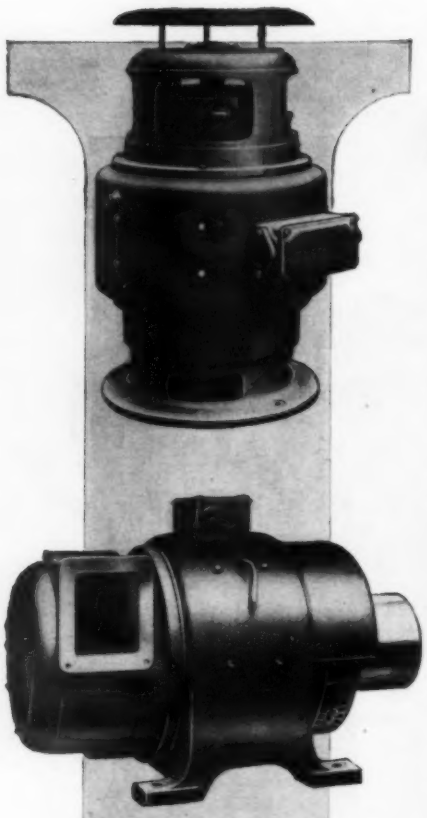
WILLESDEN WORKS:—NEASDEN LANE, LONDON, N.W. 10.

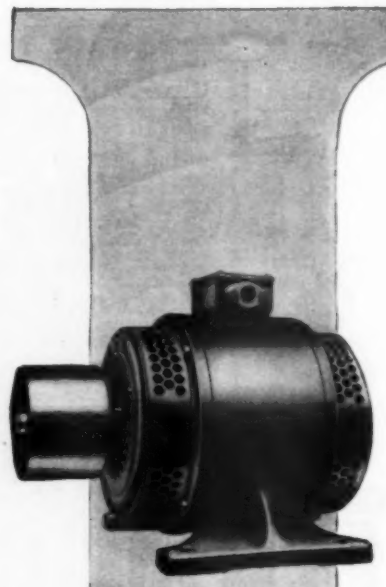
London Office: "Crown House," Aldwych, W.C.2.

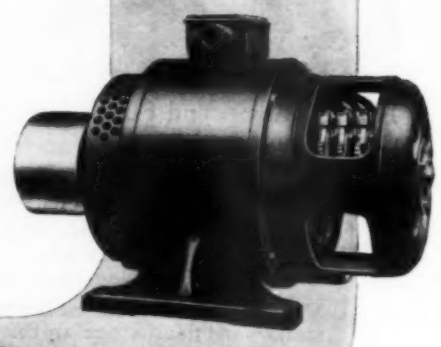
B T-H Motors

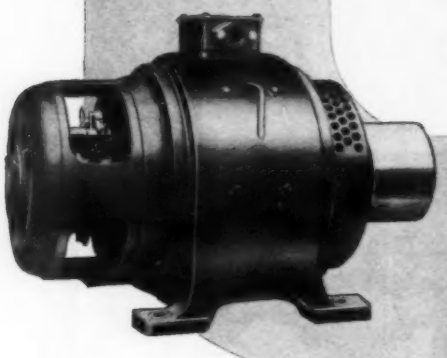
Type U

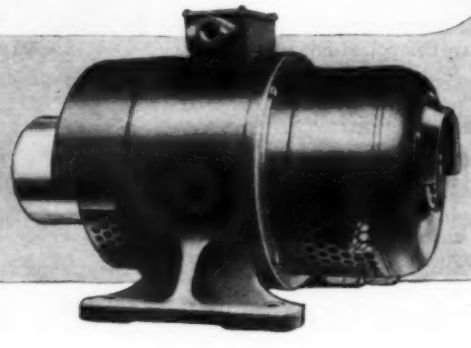
A.C. & D.C











Of entirely new design, incorporating many improvements in electrical and mechanical construction, "Type U" motors constitute a complete range of squirrel-cage, slip-ring and direct current machines of small and medium outputs.

Ball and Roller Bearings.
Grease Lubrication.
Minimum Attention Required.
Large Diameter Shafts.
Any Type of Enclosure.
Tight-Fitting Covers.
Spigoted Endshields.
Accessible Terminal Box.
Firm Foundation on Wide Feet.
Mounted at any Angle.
Insulation Exceptionally Good.
Aluminium Squirrel-Cage Rotors.
Utmost Efficiency.
Absolute Reliability.

Full particulars will be sent on request.

The British Thomson-Houston Co., Ltd.

ELECTRICAL ENGINEERS AND MANUFACTURERS

Head Office: Rugby, England. London Office: "Crown House," Aldwych.

Works: Rugby, Birmingham Willesden, Coventry and Chesterfield.

B T-H Control Gear

——and its applications

Starting Pillars
for
A.C. Slip-ring Motors
up to 450 H.P.

Non-reversing—Constant speed.

Made in two types, for industrial and mining services, for motors driving line shafting, pumps, presses, machine-tools, and other constant speed machinery.

They are totally enclosed, self-contained sheet steel pillars and are of the air-break type incorporating:—

Drum type starter. **Renewable segments.**
Controller type fingers. **Renewable finger tips.**
Slow motion starting. **Step-by-step action.**
Contactor circuit breaker. **Fireproof resistances.**
Low-voltage release. **Overload protection.**
Interlocked inspection doors.

These panels comply with Home Office Regulations and B.E.S.A. Specifications.

"TYPE ATP."

This Company manufactures control gear for every specific requirement.

The British Thomson-Houston Co., Ltd.

ELECTRICAL ENGINEERS AND MANUFACTURERS

Head Office: Rugby, England. London Office: "Crown House," Aldwych.

Works: Rugby, Birmingham, Willesden, Coventry and Chesterfield.

THE STEEL BARREL COMPANY Ltd.

Telegrams: Barrels, Uxbridge.

UXBRIDGE,

Middlesex.

Telephone: Uxbridge 251.

1000 GAL. "D" TYPE TANK.

REGISTERED DESIGN NO. 686614.

ACID RAILWAY WAGON TANK.

WELDED & RIVETTED STEEL PLATE-WORK

of every description and size.

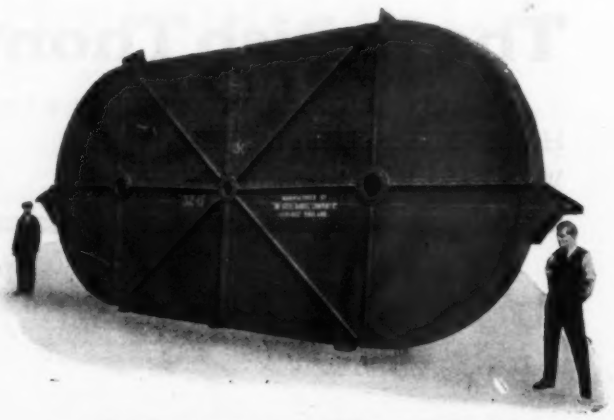
TANKS - GEAR CASES

PRESSURE VESSELS and CYLINDERS.

Also Builders of Steel Barges and Knock-down Steel Hulls for Export.

VERTICAL PRESSURE VESSEL.

DESIGNS & ESTIMATES submitted free on application to Manager, Tank Department, on receipt of full particulars of requirements.



WELDED & RIVETTED DOUBLE GEAR CASE

YARROW
BOILERS
AT
BARKING
POWER
STATION.

YARROW,
GLASGOW.

Clayton
Son & Co Ltd
Leeds
Telegrams "GAS LEEDS"
London Office
5 VICTORIA ST. S.W.I.

TANKS
FOR OIL, WATER &c.
STRUCTURAL
STEEL WORK
OF EVERY
DESCRIPTION
Gasholders &
Gasworks Plant
Boilers &c.

WELDED & RIVETTED STEEL MAINS

PECKETT & SONS, Ltd., Bristol

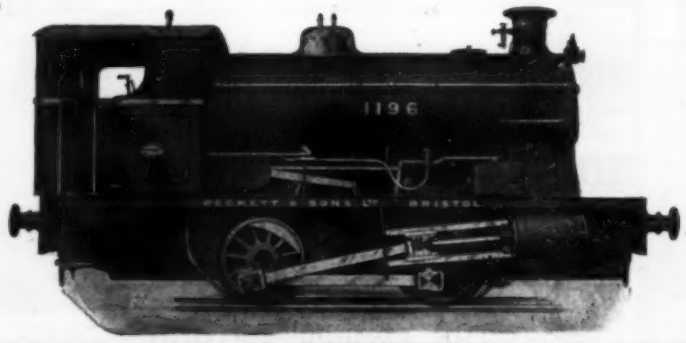
Telegrams—PECKETT, BRISTOL. London Representatives: FERGUSON & PALMER, 9, Victoria Street, Westminster, S.W.1.

Speciality

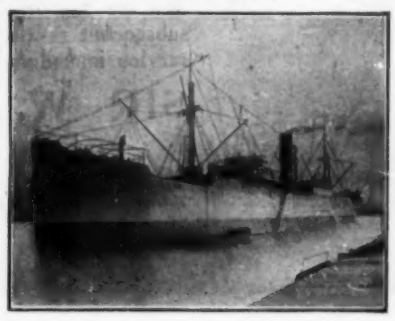
TANK
LOCOMOTIVES

of all Descriptions, and any Size or Gauge.

FULL PARTICULARS ON APPLICATION.

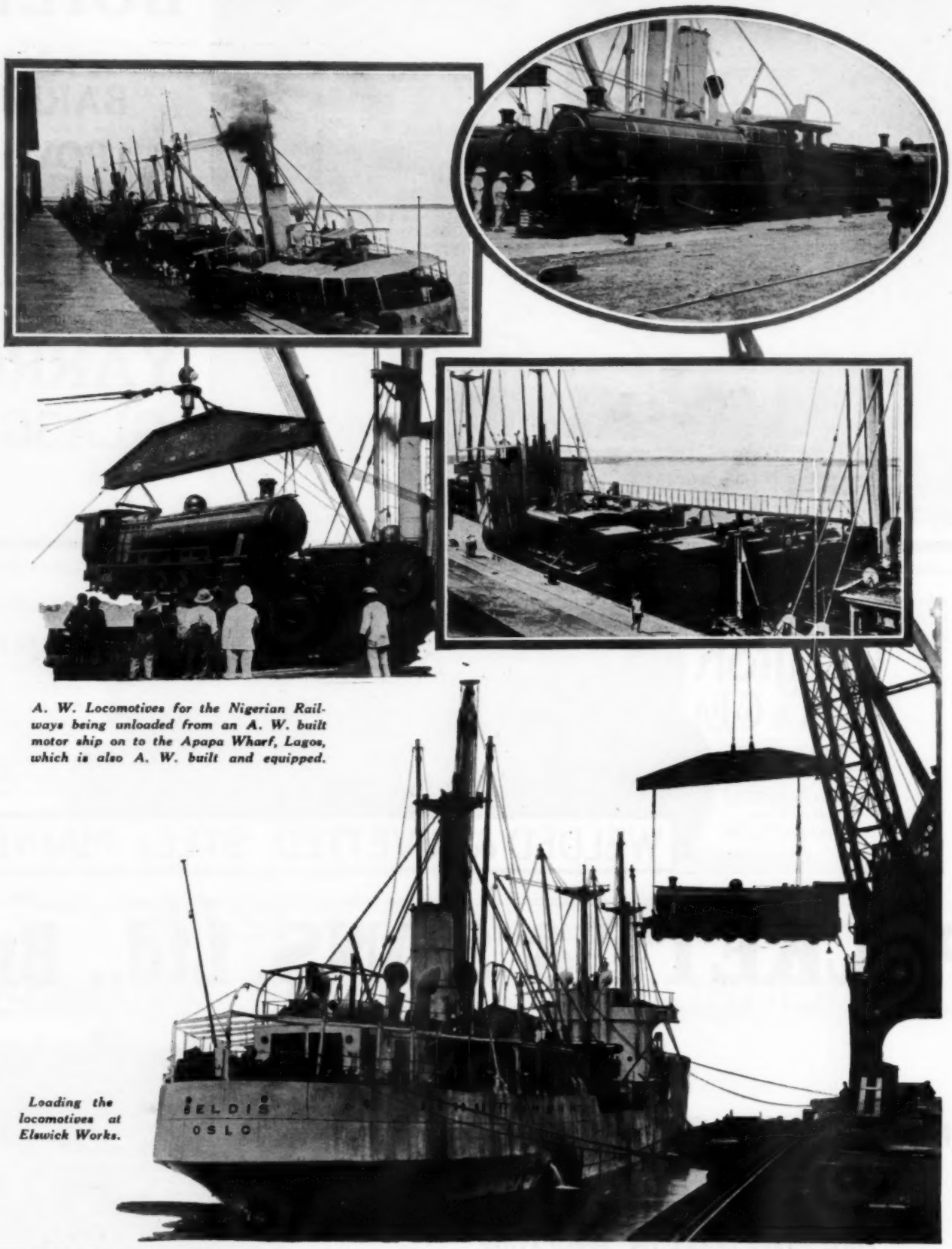


WERF GUSTO
FIRMA A. F. SMULDERS,
Engineers and Shipbuilders,
SCHIEDAM (HOLLAND),
Cranes, Dredging Materials, Coalhandling Plants, Oil Tankers
Sole Agent for the United Kingdom:
ANDERSON RODGER, 38, Victoria Street, Westminster, LONDON, S.W. 1



ARMSTRONG·WHITWORTH

SHIPS
MARINE ENGINES
LOCOMOTIVES
MACHINE TOOLS
FORGINGS CASTINGS
NON FERROUS PRODUCTS
DROP STAMPINGS
HIGH SPEED STEELS
SMALL TOOLS GAUGES
PNEUMATIC TOOLS
ELECTRIC LIGHTING SETS
COAL HANDLING PLANT
HYDRAULIC MACHINERY
DOCK EQUIPMENT
PUMPING MACHINERY
WATER TURBINES AND PELTON WHEELS
GENERAL ENGINEERING



A. W. Locomotives for the Nigerian Railways being unloaded from an A. W. built motor ship on to the Apapa Wharf, Lagos, which is also A. W. built and equipped.

Loading the locomotives at Elswick Works.

M.C. 532.

THE PROPER METHOD.

We are the originators of this method of shipping and handling locomotives which entirely eliminates dismantling and subsequent re-assembling at destination. This method not only reduces costs but allows of the locomotives being put into service immediately they are landed.

SIR W. G. ARMSTRONG · WHITWORTH & CO., LTD.,

NEWCASTLE-ON-TYNE AND MANCHESTER.

London Office: KINNAIRD HOUSE, PALL MALL EAST, LONDON, S.W. 1.

Telephone: Gerrard 9474. ode: Bentley's. Telegrams: Zigzag, Piccy London.

Clayton-Babcock

Semi-Diesel HEAVY OIL ENGINE

In Sizes 6 B.H.P. to 150 B.H.P.

The inherent Simplicity, Reliability and Accessibility of Clayton-Babcock oil engines has gained for them World-renown.

NOTEWORTHY POINTS.

A patented Crankcase Cover, which can be easily removed by unscrewing five nuts, thus exposing all the chief working parts.

No side shaft, rocking levers, skew gears, cams, valves and springs.

The Engine will work on practically any brand of crude, residual or refined oils.

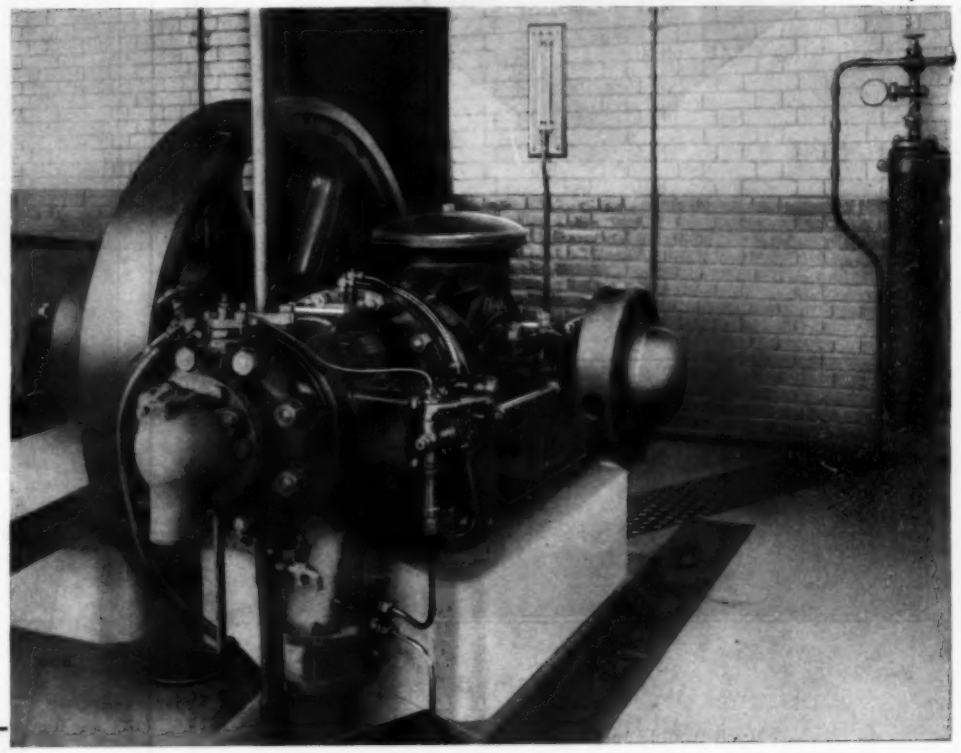
Perfect Mechanical Lubrication and Perfect Combustion.

Illustration shows a 25 B.H.P. Oil Engine driving Ram Pumps.

Write for Illustrated Catalogue EM.

Clayton & Shuttleworth, Ltd.
Lincoln.

Telegrams: CLAYTONS, LINCOLN.
Telephone: LINCOLN 760.



You can

REDUCE COSTS

by using

BRICO GROUND CAST IRON BARS

for Capstans and Automatics

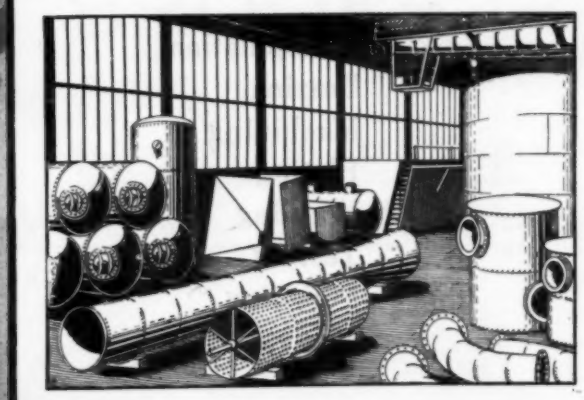
These Ground Bars can be passed through the collet, machine quite easily and give an excellent finished surface. Ground to a tolerance on the periphery of ·005in., the iron is very close grained, and we guarantee the combined carbon to be at least ·55%. Enquiries to

THE BRITISH PISTON RING CO., LTD.,
COVENTRY.

BRICO
TRADE MARK

H.P.

BOILERS · SUPERHEATERS · CHIMNEYS · TANKS



STEEL
PLATEWORK
OF EVERY DESCRIPTION CARRIED OUT TO SUIT ALL REQUIREMENTS.
HIGHEST CLASS MATERIALS AND WORKMANSHIP THROUGHOUT,
AT KEENLY COMPETITIVE PRICES.
Enquiries receive prompt attention

H. & T. DANKS (NETHERTON) LTD

BOILER MAKERS, ENGINEERS & BUILDERS
NETHERTON, DUDLEY, WORCS.
NO CONNECTION WITH ANY OTHER FIRM OF BOILER MAKERS

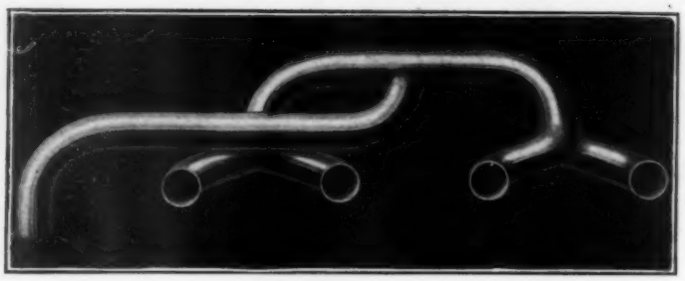
F

Finishing Processes

in

WELDLESS STEEL TUBING

at your disposal.



Much trouble and expense can often be saved by the knowledge that, just as we produce special sections of Weldless Steel Tubes, so also we have our own departments for

Manipulation
Brazing
Machining
Plating
Welding
Testing
Polishing
etc., etc.,

We can probably supply the Completed Tubular Component more cheaply than you can make it up from the raw tube.

Why not send us your specification and prove our ability to serve you?

TRADE MARK

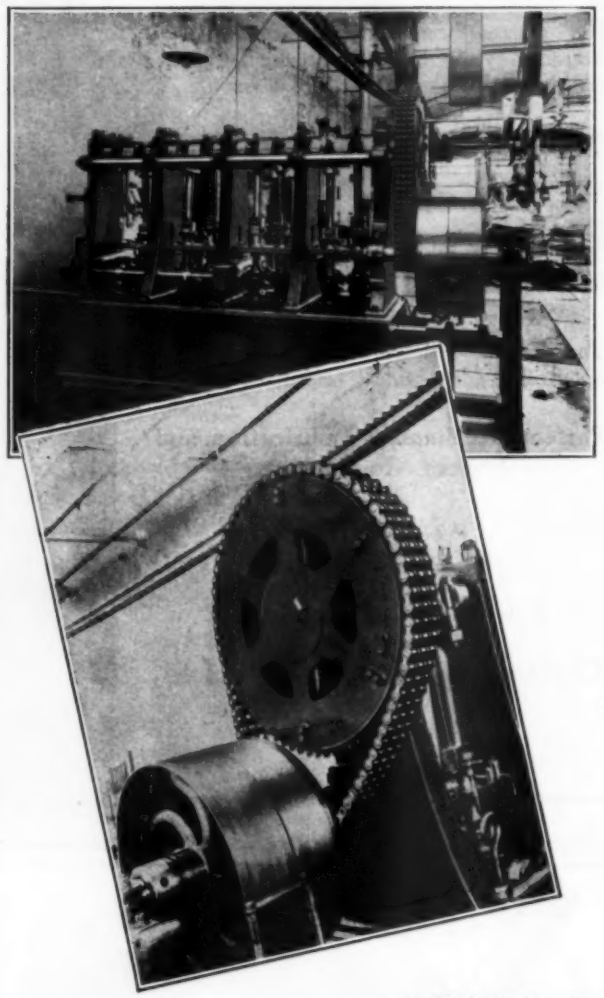
ACCLES & POLLOCK LIMITED

MAKERS & MANIPULATORS OF WELDLESS STEEL TUBING

OLDBURY BIRMINGHAM

COVENTRY CHAINS

THE LINK BETWEEN POWER & LOAD



60 H.P. Bailing Press Pump. 320/70 Revs., 15 and 68 teeth. Wheel Centres, 34 inches.

Modernised Economy

Running machinery under the most advantageous conditions means driving by chain, giving a sustained efficiency of 98%. Coventry Chains give a positive flexible drive, eliminating belt slip and waste of power by reason of worn gears. The dependability of Coventry gearing is assured by the care taken in the selection of material and the supervision of all manufacturing processes.

Specify Coventry Chains.

The Coventry Chain Co., Ltd.,

Coventry **England.**

Technical Representatives at:

	Telegrams:	*Telephones:*
London: 37, Southampton St., Strand, W.C.2.	Apohaisser Rand	Regent 3311
Birmingham: 195, Corporation Street.	Birchains	Central 1083
Glasgow: 43, Hope Street.	Superchain	Central 577
Manchester: 308, Deansgate.	Selling	Central 4497
Newcastle: Maritime Buildings.	Trio	Central 2198
Nottingham: Newcastle Chambers, Angel Row.		6934
Cardiff: R. C. Moore, Kenilworth, Hilary Gardens, Llanishen.	Moore Llanishen 181 Cardiff	Llanishen 181

Representatives for Canada:

The Coventry Company (Reg'd.). Montreal and Toronto.

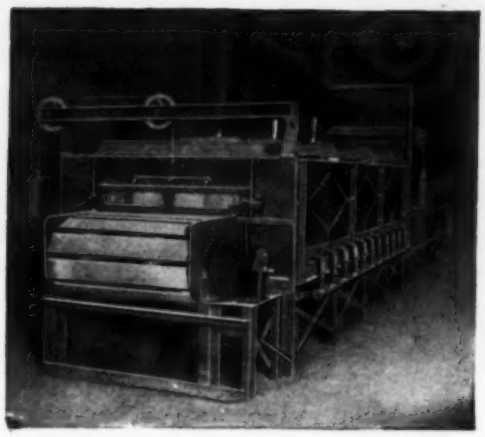
INCANDESCENT HEAT CO. LTD.,

BRITISH MILLS, CORNWALL ROAD,
SMETHWICK,
Near Birmingham.

Telegrams: "Repeat" Birmingham
Phone: 276 Smethwick.

FURNACES

FOR ALL PURPOSES AND FUELS.



End view of Conveyor type Gas Fired Furnace for Heat Treating Aluminium Pistons. Installed by us at Messrs. Morris Engines (Coventry), Ltd.
By courtesy of Messrs. Morris Engines (Coventry), Ltd.

UNIFORM HEATING,
ECONOMY IN FUEL,
INCREASED PRODUCTION,
LOW MAINTENANCE COSTS,
IMPROVED QUALITY OF PRODUCT.

CHARGING MACHINES, GAS PRODUCERS, GAS PRESSURE REGULATORS, CASE HARDENING BOXES, HEAT RESISTING CASTINGS.

SPENCER
MODERN METHODS

Most
of the existing
Coal Hoists may be adapted
to load the largest vessels now in use
by the addition of the
Spencer Conveyor
Boom.

SPENCER (MELKSHAM) LIMITED,
Melksham, Wilts.

HIGH-CLASS
DIRECT-ACTING, STEAM-DRIVEN

DUPLEX PUMP

(FOUR RAM TYPE.)

For High Pressure Hydraulic Work.

CAN BE DESIGNED FOR ANY STEAM PRESSURE.

Let Us Quote You!

Photo. No. 174.

SELF-CONTAINED AND REQUIRES VERY LITTLE FOUNDATIONS.

Complete with Hydraulic Safety Valve, Steam Control Valve, Lubricators and Drain Cocks.

PUMP BODIES OF FORGED STEEL, GUN-METAL FITTED, PLUNGERS OF STAINLESS STEEL.

HOLLINGS & GUEST, LTD.

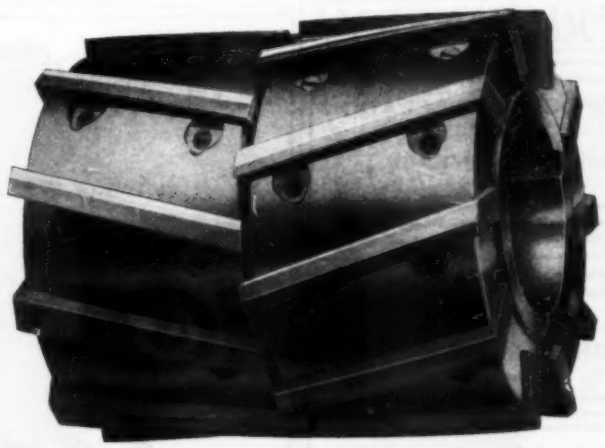
Thimble Mill Lane, Birmingham.

Telephone: East 490. Telegrams: Plungers, Birmingham.
Sole Agent for Scotland: D. LANDALE FREW, 45, Hope Street, GLASGOW.

"BROOKE"

IMPROVED TYPE
INSERTED BLADE
MILLING CUTTERS.

BLADES MADE FROM FINEST 18% TUNGSTEN STEEL.



THE NEW SECTIONED TYPE OF CUTTER CAN BE EASILY HANDLED WHEN THE NEED FOR RE-GRINDING ARISES.

THEY CAN ALSO BE GANGED IN DIFFERENT COMBINATIONS AND WIDTHS.

THE BROOKE TOOL MFG. CO., LTD.,
GREET - - - BIRMINGHAM.

Steel-Shaw

FLEXIBLE SHAFT COUPLINGS

If you require a flexible shaft coupling to be reliable, to take up malalignment of shafting or to protect your machinery from severe shocks or strains, instal one of our design.

Ask for our descriptive leaflets.

STEELE & COWLISHAW
COOPER STREET, HANLEY, STOKE-ON-TRENT

CROWN COVERINGS
FOR
BOILERS, PIPES,
ETC.
ESTABLISHED 1869.
SUTCLIFFE BROS & BRYCE
LIMITED.
London Works: Telluric Works, New Wanstead, E. 11.
Registered Office: ATLAS WORKS, HYDE.
Cardiff Works: Hodges Row, Docks.
Birmingham, Bombay, Glasgow, Newcastle, Sheffield.

T. & R. LEES LTD. Hollinwood.
WOOD WORKING MACHINERY

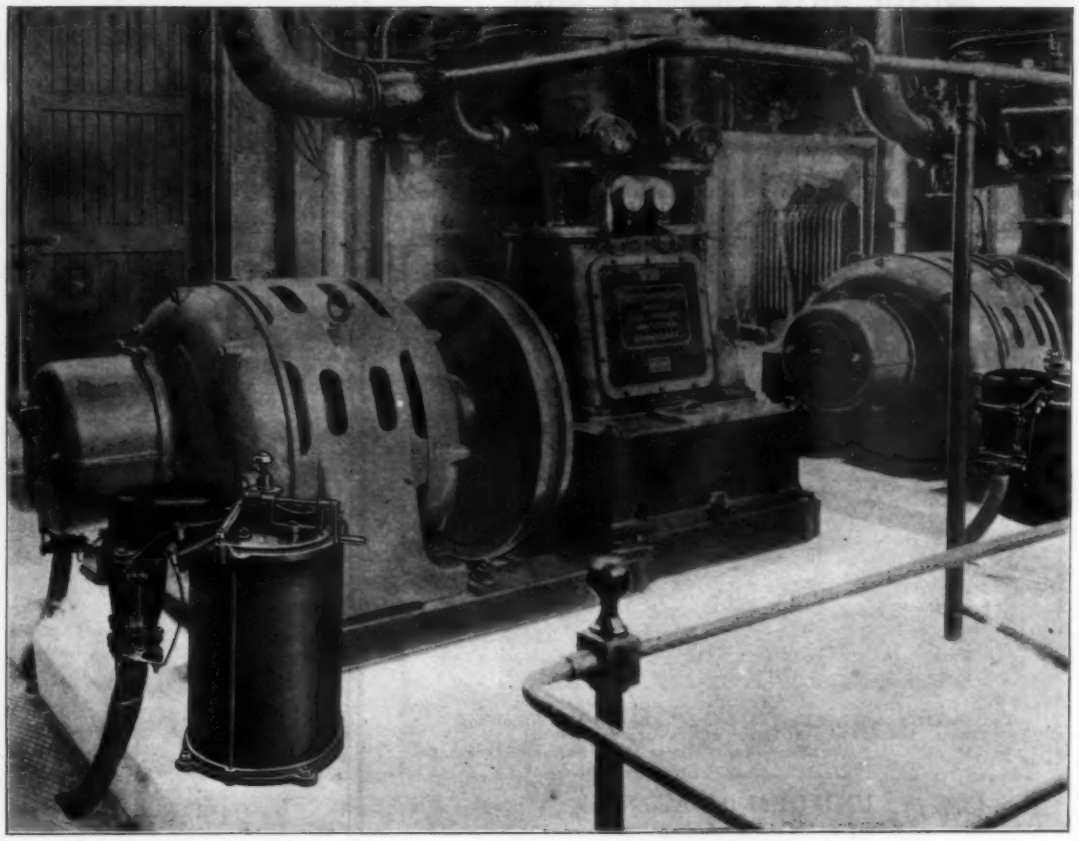
LIVERPOOL REFRIGERATION CO., LTD.,
LIVERPOOL, ENGLAND.
See last and next week's number.

CRANES
OF ALL TYPES.
JOHN GRIEVE & CO.,
MOTHERWELL.

J. W. JACKMAN & CO., LTD.,
Vulcan Works, MANCHESTER.
Manufacturers of
SAND BLAST MACHINES.

FIRE ESCAPES
FIRE EXTINCTORS
FIRE HOSE & FITTINGS
HEATHMAN,
PARSON'S GREEN, LONDON, S.W.6.

ELLISON STARTERS



Controlling the Workshops of Britain

The illustration shows Ellison Oil Rotor Starters in front of 2200 volt 110 B.H.P. motors driving Air Compressors at the Stanton Iron Works, Notts.

These Starters are appropriate accessories for heavy machinery, both in appearance and points of design. They are simple and robust, with several advantages over ordinary starters and cost practically nothing to maintain.

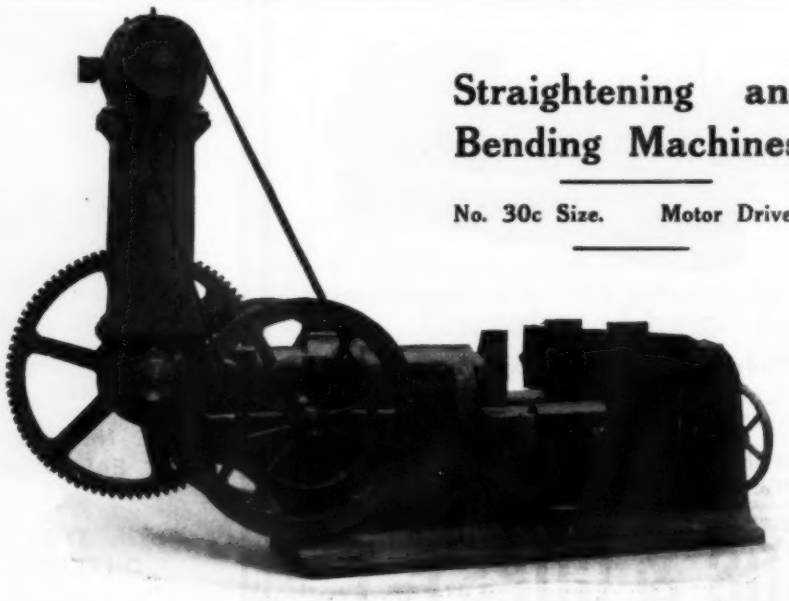
GEORGE ELLISON

Makers of Electric Control and Switchgear

Works: PERRY BARR, BIRMINGHAM.

TRADE MARK

121



Straightening and Bending Machines.

No. 30c Size. Motor Driven.

The Machine illustrated is capable of straightening or curving Sections up to R.S. Joists 14in. × 6in. × 57 lbs.

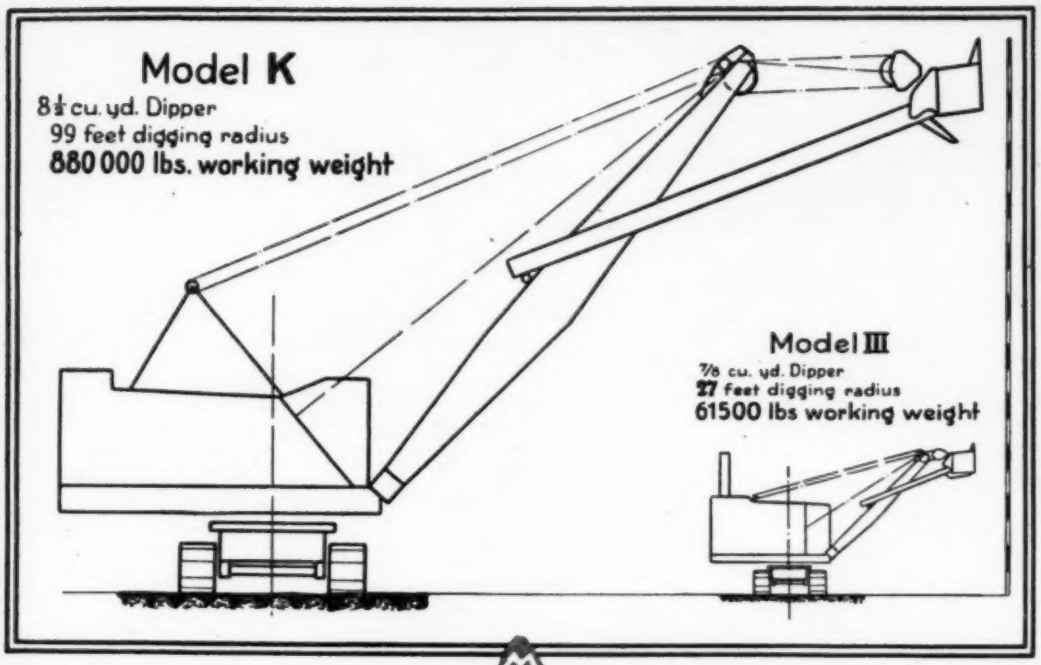
Speed of working—40 strokes per minute.

DE BERGUE & CO., LTD.,
MANCHESTER.

FROM THE SMALLEST— TO THE LARGEST

CATERPILLAR SHOVEL

WE COVER THE WHOLE FIELD OF SHOVEL DESIGN!

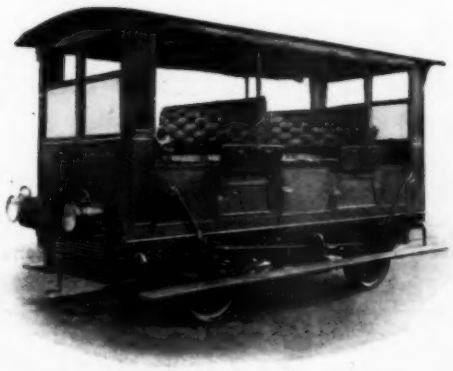


FOUNDED 1868

MENCK & HAMBROCK
ALTONA-HAMBURG

Sole Agents for Great Britain and Ireland:
R. H. NEAL & Co Ltd Plant House, Ealing, London W. 5

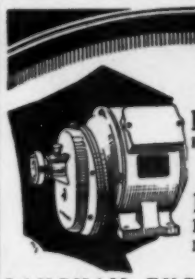
INTERNAL COMBUSTION



Standard Inspection Car to Seat Six Persons.
Horse Power to suit requirements of Speed and Gradients, etc.

COACHES, TRAMCARS, INSPECTION CARS & LOCOMOTIVES.

THE DREWRY CAR COMPANY LTD.
18, SOUTH PLACE, LONDON, E.C. 2.
Telegrams: "INNEAL, LONDON."
Telephone: LONDON WALL 4254.
WORKS: BURTON-ON-TRENT.



FOR SLOW SPEED DIRECT DRIVE BY ELECTRIC MOTORS WITH INTEGRAL REDUCTION GEARS USE
LANGHAM POWER UNITS,
D.C. & A.C., ¼ h.p. to 10 h.p.
[Write for list E.E.
LANGHAM ENGINEERING CO.
SLOUGH - - - - - - - BUCKS.

RAILWAY & WAGON CASTINGS
HARTLEY SONS & Co
ETRURIA, STOKE-ON-TRENT.

"BOSS" JOINT COMPOUNDS.

"BOSS" WHITE and "BOSS" GRAPHITE are unequalled for all kinds of screwed joints
"BOSS" GREY for caulked and flanged joints.
Always ready for use.
BRITISH STEAM SPECIALTIES,
Wharf Street, LEICESTER. Ltd.

M.F.M. FURNACES
GAS, OIL, COAL OR COKE FIRED.
The MANCHESTER FURNACES, Ltd.
Ashton New Road, MANCHESTER.

ROPEWAYS LTD.
ALDWYCH HOUSE
LONDON, W.C. 2.
'Phone: Holborn 1661 (3 lines).
Telegrams: Ropeways, London.
CONSTRUCTORS OF AERIAL ROPEWAYS ON THE "ROE" SYSTEMS.

THE
ANDERSTON FOUNDRY
CO., Ltd.,
100, CHEAPSIDE STREET, GLASGOW,
And at MIDDLESBORO'
Makers o.
STATIONARY STEAM ENGINES,
DRY VACUUM PUMPS,
AIR COMPRESSORS,
WIRE WEAVING MACHINERY,
TEXTILE MACHINERY, and
GENERAL ENGINEERS.
Telegraphic Address: "Afon, Glasgow.

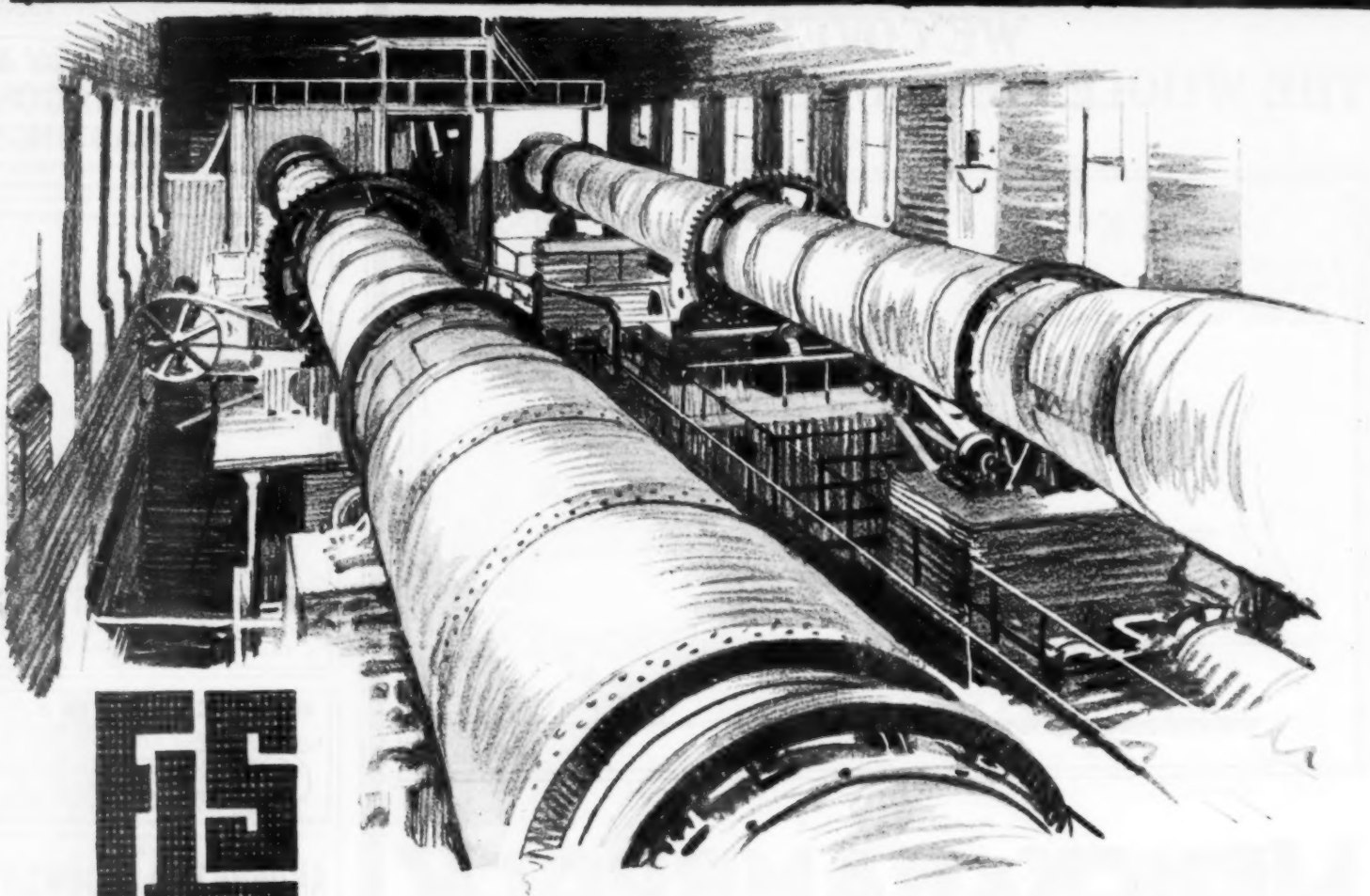
BROOKES (OLDBURY) LTD.
ENGINEERS and IRONFOUNDERS,
Near BIRMINGHAM.
Manufacturers of Brickmaking Machinery, Tube Making Plant, Presses, Drop Stamps, etc.
Transmission Gear.
GENERAL CASTINGS IN IRON & SEMI-STEEL.

TAYLOR CHUCKS

THE CHUCKS WITH THE LONGEST LIFE AND THE GREATEST GRIP.
LIST No. 58 ON REQUEST.
CHARLES TAYLOR (BIRM^M) LTD.
BARTHOLOMEW LANE
BIRMINGHAM ENGLAND.

OIL ENGINES PLENTY MARINE & STATIONARY STEAM
PLENTY & SON LTD NEWBURY, ENGLAND.

F·L·SMIDTH & Co. LTD



F·L·S

COMPLETE EQUIPMENT FOR CEMENT WORKS.

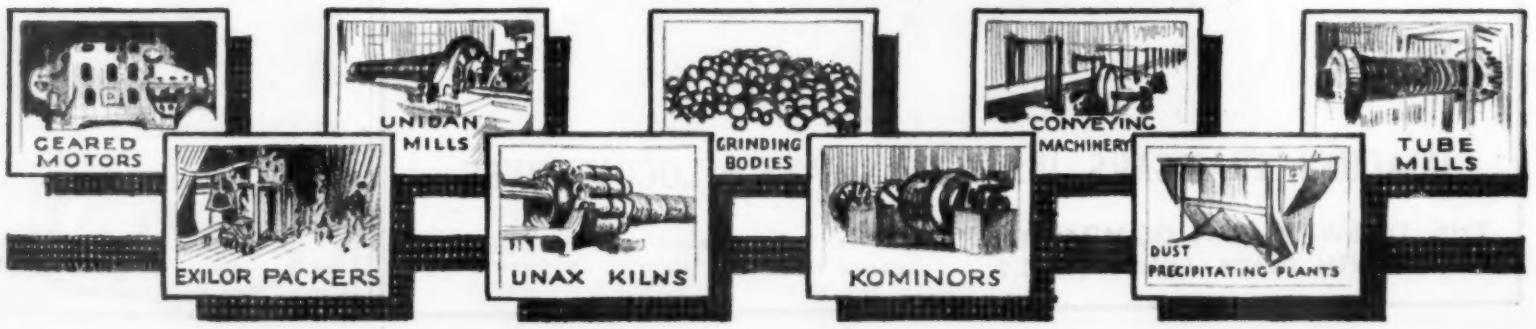
During 1925 and 1926 F.L.S. Sales included 27 Rotary Kilns with a total output of $1\frac{3}{4}$ million tons per annum and 62 Unidan Mills, with a total output of over 5 million tons per annum.

F.L.SMIDTH & Co. LTD.

ENGINEERS

VICTORIA STATION HOUSE·VICTORIA STREET

Telephone: Franklin 6107 & 6108 **LONDON·S·W·1** Telegrams: Chalkiness, Sowest, London



SULZER
BOREHOLE PUMPS

1,000 GALLONS of WATER
LIFTED 100 FT. FOR
LESS THAN ¾d.

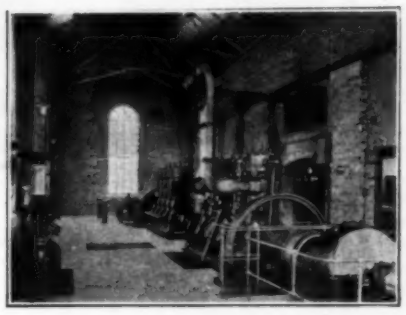
East Worcestershire Waterworks, Burcot.
Sulzer-Diesel Engine driven Borehole Pumping Plant.

A FEW OF THE SEVERAL HUNDRED PLANTS SUPPLIED.

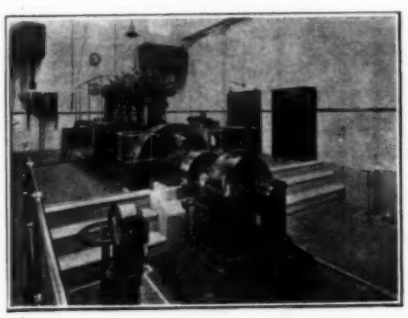
Atherstone Urban District Council.
Electrically driven Borehole Pumping Plant.

Weston-Super-Mare Urban District Council.
Sulzer-Diesel Engine driven Borehole Pumping Plant.

South Staffordshire Waterworks Company, Lichfield.
Sulzer-Steam Engine driven Borehole Pumping Plant.

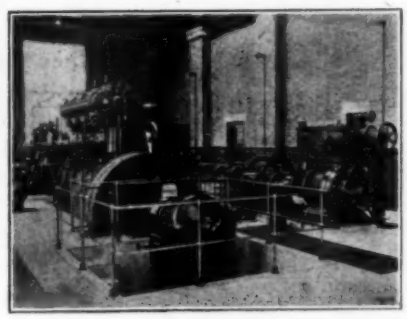


East Worcestershire Waterworks, Washingstocks.
Sulzer-Diesel Engine driven Borehole Pumping Plant.



Ipswich Corporation Waterworks, Whitton.
Sulzer-Diesel Engine driven Borehole Pumping Plant. A further set has since been installed.

East Surrey Water Company, Purley.
Sulzer-Diesel Engine driven Borehole Pumping Plant.



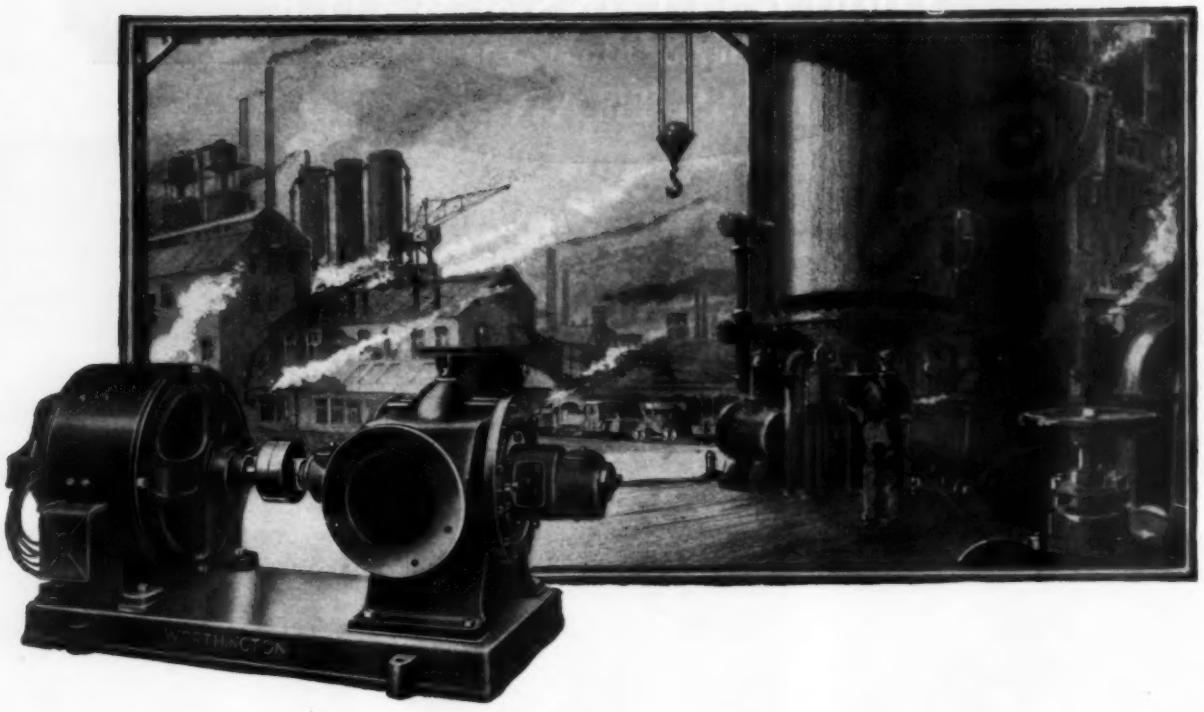
South Staffordshire Waterworks Company, Somerford.
Sulzer-Diesel Engine driven Borehole Pumping Plant.

SUCCESSFUL OPERATION GUARANTEED
WITH LIFTS UP TO 500 FT. FROM BELOW THE SURFACE.

SULZER BROS.

31, BEDFORD SQUARE, LONDON, W.C. 1.

WORTHINGTON



PUMPS IN THE INDUSTRIES

The wheels of industry are ceaseless and exacting. Every cog in the giant train of production must bear its load with steel-like service or be discarded.

When that unit is a pump you want full satisfaction that it can do its job and keep on doing it all the time.

You want a pump that is made for work—real *hard* work and real *good* work.

Then go to the engineers who specialise in pumps; Engineers who have stuck at nothing to produce the right kind of pumps to serve the industries.

WORTHINGTON PUMPS.

"Efficient Simplicity."

WORTHINGTON-SIMPSON, LTD.,

TELEPHONES:
3048
3049
3050
HOLBORN.

QUEEN'S HOUSE, KINGSWAY,

LONDON, W.C.2.

CABLES AND TELEGRAMS:
"PUMPING, WESTCENT, LONDON."

A, 3.

HUDSON Tipping WAGONS

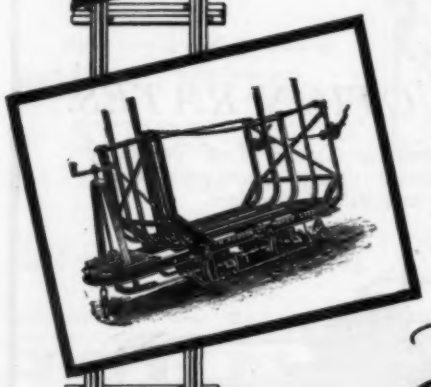
BUILT TO LAST!

This is our aim in building Hudson Wagons.

TO design and combine the finest materials into Wagons of great strength and stability and to anticipate your requirements by manufacturing standard sizes and designs on a mass production basis so that you can obtain immediate delivery:

To this end our organisation of designers and engineers is devoted. Our technical knowledge of every phase of Light Railway Work, our sixty years' experience in requirements for all parts of the world and our great manufacturing resources combine in making Hudson Wagons the best obtainable, and the cheapest in the long run. Whatever your Railway Requirements may be, avail yourself of our experience. We shall be glad to offer our advice on any Problem that confronts you.

Write for the Hudson Catalogue of Light Railway Material.



Robert Hudson
LIMITED.
Head Offices: 38A, BOND STREET, LEEDS.

Works: Gildersome Foundry, near Leeds.

Telephones: Leeds 20004. Telegrams (all offices): "Raletrux." Codes: ABC (5th & 6th), Bentley & Marconi.

LONDON OFFICE: Suffolk House, Cannon Street, E.C. 4. Tel.: Royal 7772.

MAURITIUS: P.O. Box 118, Port Louis.

AFRICA: **Robert Hudson & Sons, Ltd.** Johannesburg: P.O. Box 5744. Lourenco Marques: P.O. Box 177. Durban: P.O. Box 1007. Salisbury: P.O. Box 586. Bulawayo: P.O. Box 322. Loanda: P.O. Box 265. Beira: P.O. Box 292.

INDIA: **Robert Hudson (India), Ltd.** Calcutta: P.O. Box 23. Karachi: P.O. Box 173. Works: Kidderpore.

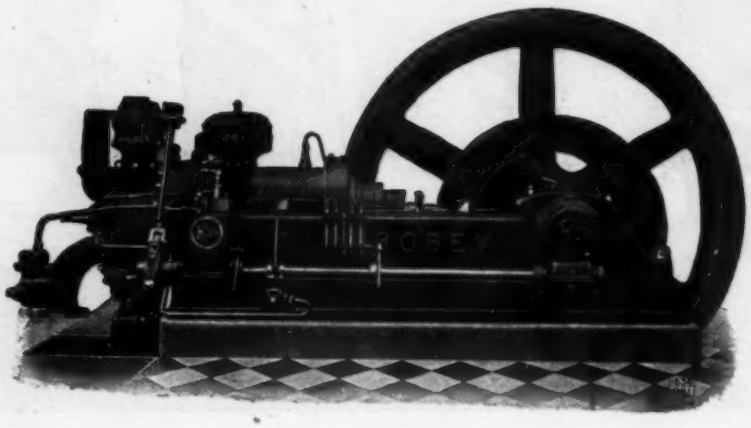
EGYPT: **Robert Hudson, Ltd.** Cairo: P.O. Box 1446. Also at Alexandria.

C·A·A·

ROBEY

(Oil Engine Makers since 1891).

ECCENTRIC
VALVE
GEAR



MAXIMUM ECONOMY
MAXIMUM EFFICIENCY
MINIMUM UPKEEP

COLD START CRUDE OIL ENGINES

HORIZONTAL AND VERTICAL.

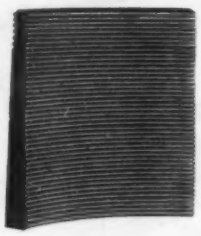
MADE LIKE A STEAM ENGINE :: RUNS LIKE A STEAM ENGINE

Works: LINCOLN. **LONDON OFFICES: 91, Queen Victoria St., E.C.4.**

POWER PLANT
RICHARDS THREAD MILLING MACHINE.

Accurate Threads

AT EXCEPTIONAL PRODUCTION RATES.

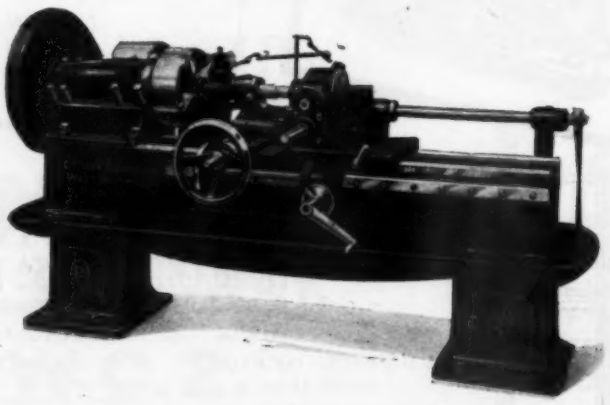


THE POWER PLANT RICHARDS THREAD MILLER represents a distinct advance upon all existing systems for producing accurate thread work.

INTERNAL and external threads for all diameters up to 30 in. Tapered and opposed tapered threads for sockets such as used in Pipe Lines on the Oil fields.

THE meticulous accuracy of threads obtainable by Richards system enables the employment of a metal-to-metal joint to withstand high pressures without the intervention of a packing medium.

TO-DAY the great variety of Thread work previously regarded as essentially Centre Lathe work is now done on Thread Milling Machines.



The POWER PLANT CO., LTD.
WEST DRAYTON, MIDDLESEX.

Write for List W.F. 173 describing and illustrating the range of Power Plant Richards Patent Thread Milling Machines.

Printing.—George Reveirs, Ltd., 4/5, Greystoke-place, Fetter-lane, E.C., are PREPARED to SUBMIT ESTIMATES for all DESCRIPTIONS of PRINTING. "The Engineer" has been printed at this establishment since its commencement.

PATENTS, DESIGNS, AND TRADE MARKS.

Harris & Mills, Chartered Patent AGENTS, 34 and 35, High Holborn, London.
Tel. Ad.: "Privilege," London. Tel. No.: Chancery 7763.

THE CLASCOW RAILWAY ENGINEERING COMPANY LTD.
GOVAN, GLASGOW.
London Office:—12, VICTORIA STREET, S.W.
MANUFACTURERS OF RAILWAY CARRIAGE, WAGON & TRAMWAY WHEELS & AXLES, CARRIAGE AND WAGON IRONWORK, also CAST STEEL AXLE BOXES.

GLASGOW ROLLING STOCK & PLANT WORKS.
HURST, NELSON & CO., LTD.,
BUILDERS OF RAILWAY CARRIAGES, WAGONS, ELECTRIC CARS, and every other description of RAILWAY and TRAMWAY ROLLING STOCK.
Makers of WHEELS, AXLES, RAILWAY PLANT, FORGINGS, SMITH WORK, and IRON and BRASS CASTINGS.
Registered Office and Chief Works: MOTHERWELL.
Cardiff Office: Gordon Chambers, 31, Queen Street.
London Office: 32, Great St. Helen's, Bishopsgate, E.C. 3.
See Illustrated Advt. page 91 last week.

P. & W. MACLELLAN LTD.,
CLUTHA WORKS, GLASGOW,
Manufacturers of RAILWAY WAGONS and CARRIAGES, IRON and STEEL SLEEPERS, FISHBOLTS, SPIKES, and other PERMANENT WAY MATERIAL, BRIDGES, and ROOFING.
CONTRACTORS for RAILWAY PLANT and STORES of every description.
Chief Office: 128, Trongate, GLASGOW.
Registered Offices: Clutha House, 10, Princes Street, Westminster, London, S.W. 1.

G. R. TURNER, LTD.
Manufacturers of
RAILWAY ROLLING STOCK & MINING MACHINERY
For Home and Abroad.
Specialities:
Railway Wagons of every description. Tipplers.
Colliery Screening Plants. Elevators & Conveyors
Steel Headgears and Rope Gears. Structural Steel Work.
Haulage Gears. Forgings and Castings.
Chief Works & Office: LANGLEY MILL, nr. NOTTINGHAM
London Office: 32, Victoria Street, S.W. 1.
(Illustrated Advt. first issue in each month on page 8.)

HIGH CLASS MACHINE HULSE & CO. LTD. ORDSALL WORKS MANCHESTER TOOLS SPECIAL & STANDARD
See Illustrated Advertisement, June 10th, page 64.

HEAT ROYLES LTD. IRLAM. MANCHESTER ECONOMY

A CLEVER INVENTION FOR RAISING WELL WATER
The Boulton Water Elevator lifts a continuous stream of water from wells of any depth. No pipes, no valves or plungers, cannot freeze. Can be fixed within an hour without skilled labour. Thousands in daily use. *Write for Catalogue* 713.
Boulton & Paul, Ltd., Norwich.

Stand No. 150 Royal Show, Newport July 5-9.

Contractors to the ADMIRALTY and WAR OFFICE.

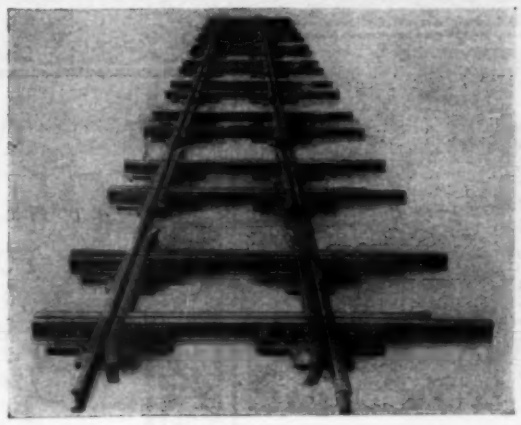
Manufacturers of all kinds of
BOLTS, NUTS and STUDS, &c.,
in IRON and STEEL

EDWARD MERCER, LTD.
HOLLINS IRONWORKS,
HOLLINWOOD, near MANCHESTER.

Braby's Eclipse Steel Lockers and Steel Furniture
High Grade Quality. Favourable Prices.
F. Braby & Co., Ld.
Glasgow.
Also at London, Liverpool and Bristol.

THOMAS
SUMMERSON & SONS, LTD.,
RAILROAD TRACK SPECIALISTS.

A Group of Square Crossways Recently



Installed in a Large Power Station.

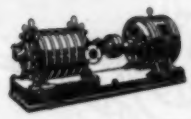
TELEPHONES: 2660 & 2669.
TELEGRAMS: SUMMERSON.
DARLINGTON.

MANUFACTURERS OF SWITCHES & CROSSINGS TURNOUTS, TUB ROADS, RAILROAD ACCESSORIES.

LEDWARD & BECKETT, LTD.
PARLIAMENT MANSIONS, VICTORIA ST. WESTMINSTER, S.W. 1.
(Opposite Post Office.)
Makers of **EJECTOR CONDENSERS**
for TURBINES or RECIPROCATING ENGINES.
AUTO. VALVES, VACUUM BREAKERS, ETC.
Catalogues on application.
New Telephone Number: Victoria 8415. Telegraphic Address: Preferment, Sowest, London.

INTERNATIONAL COMBUSTION LTD.
INCORPORATING HARDINGE CO. for EASTERN HEMISPHERE.
GRINDING & PULVERIZING OFFICES,
11, Southampton Row, London, W.C. 1.
'Phone: Holborn 6646. Cable & 'Grams: "Lopulco, Westcent, London."
WORKS:—BARROW-IN-FURNESS — DERBY — ERITH.
GRINDING AND SCREENING SPECIALISTS.

FOR ILLUSTRATING -USE **SWAINS' BLOCKS**
Indispensable in all kinds of Advertising and Illustration work for Engineers
JOHN SWAIN & SON, LTD
89-92, SHOE LANE, LONDON, E.C.4
Works: High Barnet. And at Glasgow, Manchester, Bristol and Paris

Holden & Brooke Ltd
CHEAP PUMPS ARE EXPENSIVE
Do not buy on price alone —— compare the specifications
1 Design
2 Workmanship
3 Materials

HOLDEN & BROOKE
CENTRIFUGAL
PUMPS
for all duties
HOLDEN & BROOKE LTD
SIRIUS WORKS WEST GORTON
MANCHESTER
LONDON OFFICE
818 ABBEY HOUSE WESTMINSTER SW1
Holden & Brooke Ltd

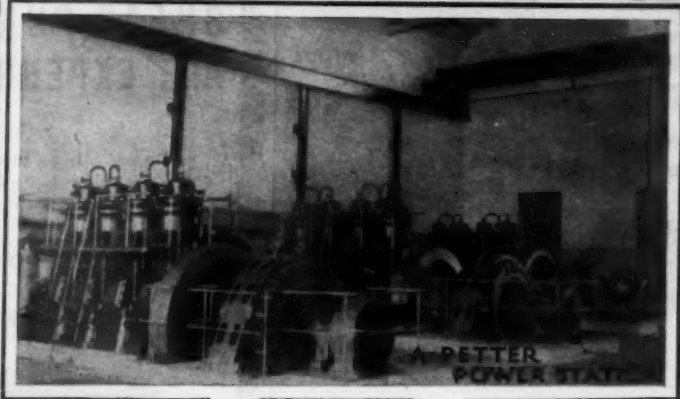
CAST IRON PIPES
¾in. to 12in. Bore, for EVERY PURPOSE.
THOMAS ALLAN & SONS LTD.
SON LEA FOUNDRY,
THORNABY-ON-TEES.

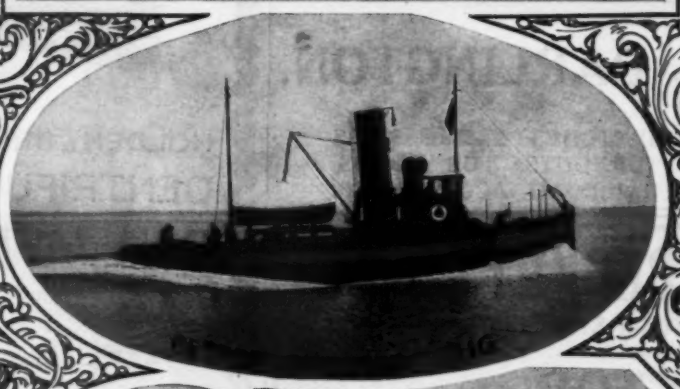
JOHN OAKEY & SONS,
MANUFACTURERS. LIMITED,
GENUINE EMERY.
EMERY CLOTH.
EMERY, CORUNDUM, CARNET & FLINT **TAPE**
GLASS PAPER, BLACK LEAD.
FLINT AND CARNET PAPER.
N.B.—All Papers and Cloths are supplied in Rolls, Bands, Discs, Strips, and Sheets of almost any size and shape, to suit the special requirements of buyers. Prices quoted on receipt of particulars.
EMERY AND CORUNDUM DISCS
Of Cloth & Paper, for all Disc Grinding & Polishing Machines.
EMERY WHEELS
WELLINGTON WORKS, WESTMINSTER BRIDGE ROAD, LONDON, S.E. 1.

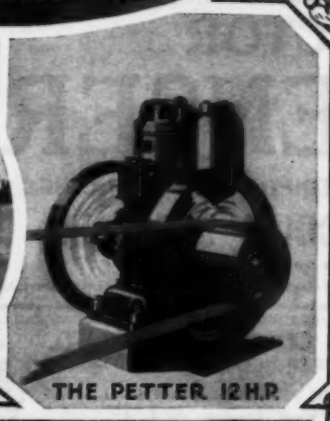
"I have much pleasure in testifying to its efficiency."—LORD KELVIN.
Boyle's
LATEST PATENT "AIR-PUMP" VENTILATOR
FOR BUILDINGS AND SHIPS.
HAS DOUBLE AND EXTRACTING POWER OF EARLIER FORMS.
OVER ONE MILLION IN US
Awarded the £50 Prize with Diploma (only pr offered) at the International Ventilator Tests, London Highest Award. International Ventilator Tests, Paris Two Gold Medals with Diploma.
"Its complete success in securing the required continuous upward impulse is testified to by high authorities.—GOVERNMENT REPORT (Blue Book).
ROBERT BOYLE & SON,
VENTILATING ENGINEERS,
65, HOLBORN VIADUCT, LONDON.
Telephone: CENTRAL 4083.
("Messrs. Robert Boyle and Son, the founders of the profession of Ventilation Engineering, have raised the subject to the dignity of a science."—REPORT ON THE VENTILATION OF THE LONDON CUSTOM HOUSE.

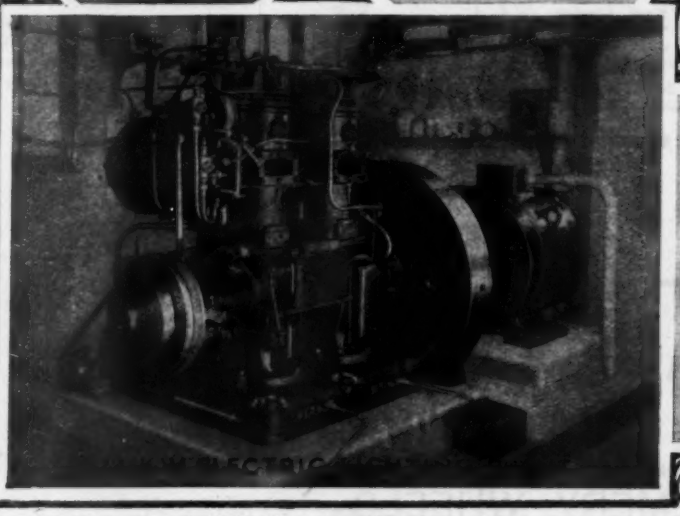
PETTERS LIMITED

MANUFACTURERS OF TWO-STROKE CYCLE DIESEL AND SURFACE IGNITION INDUSTRIAL AND MARINE OIL ENGINES









TWO-STROKE CYCLE
OIL ENGINES
FOR ALL PURPOSES.

1½ to 2000 Horse Power.

"C" Type—up to 2000 H.P. Heavy Oil Engines with completely cooled combustion chamber, Low Pressures, Low Temperatures, Airless Injection, Greater Fuel and Lubrication Economy than 4-stroke cycle engines.

"S" Type—made in six sizes, 5, 8, 12, 18, 24, 36 H.P. Surface Ignition Engines working on Crude Oil or Paraffin. Instant Starting from cold without preheating. Marine Types ensure against fire at sea as no petrol is used by Petter-Marine Engines The Perfect Engine for Medium Power Purposes.

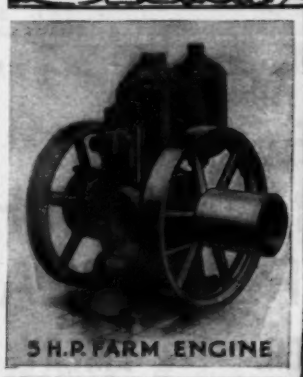
"M" Type—made in three sizes, 1½, 3 and 5 H.P. Work on Petrol/Paraffin with Magneto Ignition. Suitable for Agricultural Purposes and small electric lighting plants like the Petter-Light which is ideal for Home, Farm, Shop and Factory.

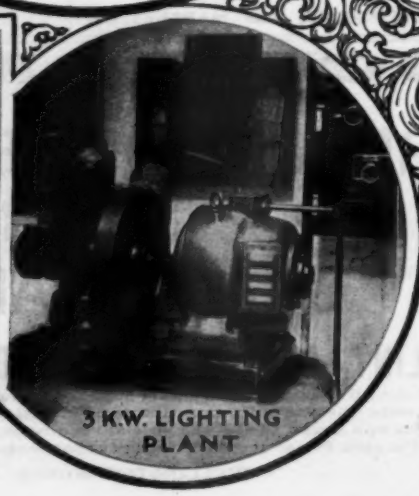
SIMPLE — RELIABLE — ECONOMICAL.

Enquiries solicited.

London Offices & Showrooms: 75b, Queen Victoria Street.

WORKS:
YEOVIL & IPSWICH





Broadway, New York, demanded

"FERROCRETE"

The rapid-hardening Portland Cement

For portions of the foundation in the repaving of Broadway, "FERROCRETE" was the only Portland cement which *could* be used.

The New York City Engineer's specification called for a concrete 12 inches thick for the intersections mixed 1-3-6, using a rapid-hardening cement, giving at least 250 lbs. tensile strength in the first day and showing no retrogression in strength after twenty-eight days.

"FERROCRETE" was the only Portland cement which met this specification.

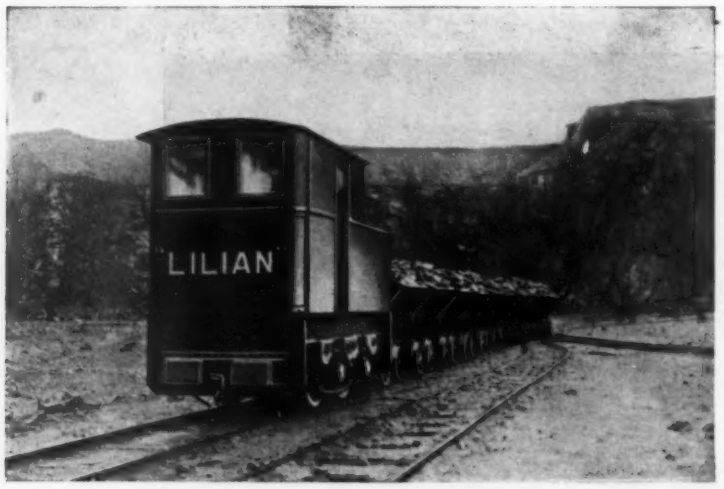
"FERROCRETE" gives concrete when 4 days old the strength of concrete made with ordinary Portland cement when 28 days old.

For concrete work of every kind use

"FERROCRETE"

The rapid-hardening Portland Cement.

THE CEMENT MARKETING COMPANY, LIMITED, Selling Organisation of The Associated Portland Cement Manufacturers Ltd., The British Portland Cement Manufacturers Ltd., Portland House, Tothill Street, Westminster. Telegrams: "Portland, Parl, London."



Truth Will Out!

[illegible] that for every man employed, each day between 3 and 4 tons of stone descend the quarry inclines, even after making allowance for natural contingencies!

On the quarry tracks a quiet little "Sentinel" loco (which we christened "Impudence") was doing its many heavy duties with commendable efficiency and quietness, climbing even gradients of 1 in 30 with 30 or 35 steel buggies. Gravity pushed down the loaded buggies, and where it could not be made to pull them up as well the "Sentinel" did so. In a siding, forlorn, neglected, and a sorry spectacle, stood "Dignity," a standard sturdy loco, once a pride and picture of beauty, consigned to this oblivion by her voracious appetite: 15 cwts. of coal per day. "Impudence" in full work consumes but 3 cwts.! It would seem that there exist some mechanical engineers who are not the mediocre fry we civils like to think they are. A physiologist would find in the incident a moral.

Crushing Plants.—There are three main crushing plants, numbered respectively No. 4, No. 7, No. 8, and in addition a "Fine Crushing Plant. Stockpile of quarry [illegible]

Abstract from an article on "The Titterstone Clee Hill Quarries of Messrs. Field & Mackay, Limited," by Mr. T. P. Francis, A.M.Inst.C.E., F.S.I., which was published in the April 13th, 1927, issue of "The Contractors' Record and Municipal Engineering." The "Sentinel" locomotive referred to is shown in the photograph above.

A booklet comprising articles touching on various phases of railway work will be sent to Railway Officers who are interested.

The "Sentinel" Waggon Works, Ltd., Railway Department,
20, Iddesleigh House, Caxton Street, London, S.W.1.

SPIRAL MANUFACTURERS SINCE 1880

A Lift for the Banana

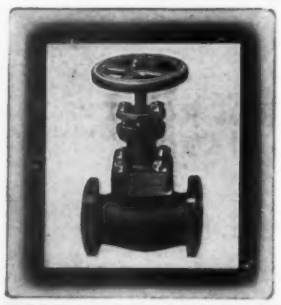
HERE is an Elevator for handling Crated Bananas. The crates, each weighing 1 cwt., are being lifted through a vertical height of 26 feet, and delivered at the rate of 200 per hour. The Elevator works through two floor levels and the crates can be loaded or unloaded on either floor. It is fitted with a variable speed motor for controlling the rate of handling, and it can be stopped or started from either level.

This type of Elevator is suitable for handling all kinds of market produce packed in crates.

We claim that we can efficiently solve *your* Mechanical Handling problems of any nature whatever; will you give us the opportunity?

THE NEW CONVEYOR CO. LTD
SMETHWICK, NR. BIRMINGHAM
Telephone: 50 Smethwick. *Telegrams: "Aptitude, Birmingham."*

SPIRAL MANUFACTURERS SINCE 1880



A J. & E. Hall Service with a J. & E. Hall Guarantee for Special Fittings.

FOR generations J. & E. Hall Ltd. have manufactured refrigeration plant of such quality as to set the highest standard recognised by users and manufacturers alike.

J. & E. Hall Ltd. have a special Foundry and machine shop for the production of parts not obtainable in the ordinary way and any special apparatus in connection with oil refining and mechanical cooling processes.

All work undertaken by J. & E. Hall Ltd. of a non-standard nature carries the same iron-clad guarantee as standard fittings.

J & E. HALL, LTD.
DARTFORD, KENT

REFRIGERATING *and* ICE MAKING PLANTS

London Office:-
10, ST SWITHIN'S LANE, LONDON, E.C.4.

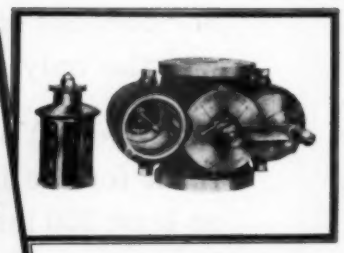
121/123, Charterhouse St., London, E.C.1 (*Showroom*).
90, Victoria Street, Bristol (*Showroom*).
81, Dale Street, Liverpool.

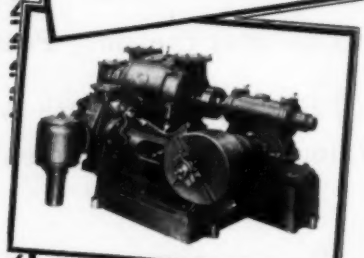
FOUNDED 1785, By JOHN HALL.

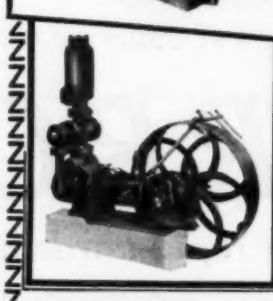
21, Oxford Street, Manchester (*Showroom*).
71, Exchange Buildings, Birmingham.
Queen's Road, Belfast.
London Service Depot—1 & 2, Silex Street, S.E.1.

PUMPS & FILTERS

ZWICKY







SINGLE FILTERS
Low pressure types suitable for all directions of flow. Marine type fitted with bulkhead flange. Capacities to 20,000 Galls. per hr.

DUAL FILTERS
The centre control combines a change over and shut-off cock. Cages fitted with any size gauze or wire cloth to suit fluid. Capacities to 10,000 Galls. per hr.

HAND PUMPS
28 Foot Suction—400ft. Head. Capacities to 30 Galls. per min. Cylinder constantly primed. Mounted on bulkhead bracket for ship work.

POWER DRIVEN PUMPS
28 Foot Suction—500ft. Head. Capacities 100 tons per cylinder per hour. Suitable for any type of drive. Large valves in streamline of fluid. Hand or Automatic drain and relief Valve fitted to all types of pumps.

As supplied to H.M. Government and leading Oil Companies.

ZWICKY LTD., SLOUGH, BUCKS.
'PHONE: SLOUGH 332.
'GRAMS: ZWIKLIM, SLOUGH.
CODES: BENTLEY'S, A.B.C. 5th Edition.

BEFORE USE.

CARRON COMPANY *specialise in the manufacture of all types and sizes of* HAULAGE GEARS.

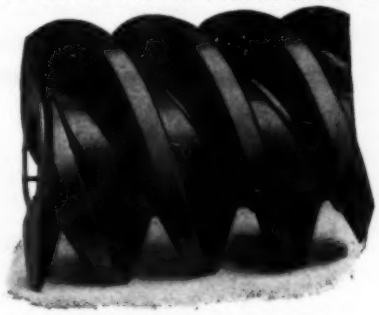
Illustrations show Phosphor Bronze Worm on one of Carron Company's 200 h.p. Single Endless Rope Haulage Gears before and after six years' continuous service, showing the small amount of wear having taken place during that period.

AGENTS FOR SCOTLAND:
Messrs. Hunter & Warren, Ltd., 19, Waterloo Street, Glasgow.

AGENTS FOR SOUTH WALES & MONMOUTHSHIRE:
Messrs. Fred Phillips & Co., 60 & 61 Mount Stuart Square, Cardiff.

Haulage Gear Catalogue No. 32G post free.

CARRON COMPANY FOUNDED 1759. Engineering Department, CARRON, Stirlingshire.



AFTER SIX YEARS' SERVICE.

Removal & Recovery of DUST

The "Centigrad" patent Dust Control Unit is a most compact machine for the removal or recovery of dust.

No discharge piping is required and the suction piping is reduced to a minimum. Economy in power is effected, as the unit need only be operated when the machine to which it is connected is running.

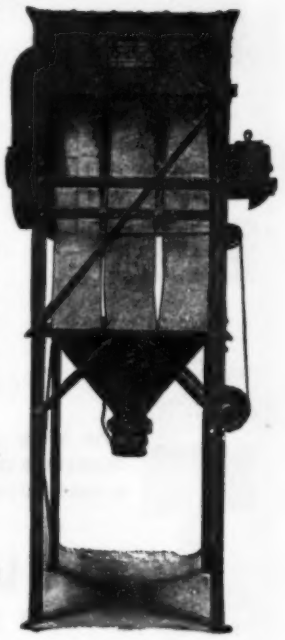
Dust of varying grades or from different materials can be kept separate and valuable dust recovered.

There is no loss of heat during the Winter, the filtered air being returned to the room.

We also specialise in the manufacture of complete Dust Control and removal plants for all trades.

Write for leaflet D3a/1 post free on request.

For personal interview and advice 'phone our nearest branch.



MUSGRAVE & Co LTD
ENGINEERS · BELFAST
LONDON · CARDIFF · MANCHESTER

Telephones:
BELFAST 4161-2-3. LONDON, HOLBORN 884.
MANCHESTER, CITY 1838 CARDIFF 2236.

For Brakes and Clutches

BIG FIGURES
760,000,000

which represent the ft. lbs. of energy that may be absorbed by 1 cubic inch of FERODO FIBRE, the most enduring and powerful friction fabric known for brakes and clutches where excessive heat is not generated.

FERODO BRAKE & CLUTCH LININGS

cover all requirements.
Specify **FERODO BONDED ASBESTOS** if heat is in excess of 280° F.

FERODO LTD., Chapel-en-le-Frith.
DEPOTS and AGENCIES — London, Birmingham, Leeds, Manchester, Bristol, Belfast, Newcastle, Glasgow, Aberdeen, Cardiff, Carlisle, Brighton and Liverpool.

A 467.

There are a limited number of prominent spaces still available.

SEPTEMBER 8 to 24, 1927, OLYMPIA, LONDON, W.

THE NINTH

1906
1907
1910
1912
1919
1921
1923
1925
1927

THE BEST

F. W. BRIDGES & SONS, LTD.,
Avenue Chambers, 4, Vernon Place,
LONDON, W.C. 1.

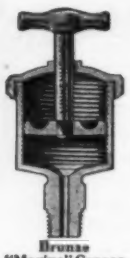
LUNKENHEIMER

GREASE CUPS

Insure positive delivery of the correct amount of grease to the bearings, without wasteful leakage.

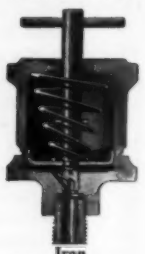
Bronze "Ideal" Grease Cup Automatic Feed

Brass "Jewel" Grease Cup Automatic Feed



Brunse "Marine" Grease Cup Plunger Screw Feed

Bronze "Atlas" Grease Cup Plunger Screw Feed



Iron "Apollo" Grease Cup Automatic Feed

Bronze "Positive" Grease Cup Packed Base Cap Screw Feed

Bronze "Tiger" Grease Cup Packed Base Cap Screw Feed

Brass "Gem" Grease Cup Plain Base Cap Screw Feed

Pressed Steel "Ferro" Grease Cup Plain Base Cap Screw Feed

The wide range of designs, sizes and capacities offers a selection of the proper grease cups for any service condition.

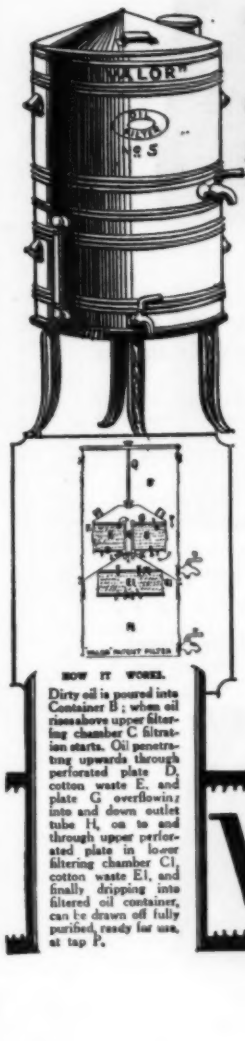
THE LUNKEN CO., LTD.

35 GREAT DOVER STREET, LONDON, S.E.

Telegraph Address: "Lunken", London

Pressed Steel "Securo" Grease Cup Spring Lock Cap Screw Feed

23-20-21


VALOR
HOW IT WORKS.
Dirty oil is poured into Container B; when oil rises above upper filtering chamber C filtration starts. Oil penetrating upwards through perforated plate D, cotton waste E, and plate G overflowing into and down outlet tube H, on to and through upper perforated plate in lower filtering chamber C1, cotton waste E1, and finally dripping into filtered oil container, can be drawn off fully purified, ready for use, at tap P.

The Money you lose in dirty Oil would soon pay for a VALOR OIL FILTER

"The Filter that Works by itself."

YOU can soon effect a huge saving by filtering the dirty oil from your engines, dynamos, presses, etc., in a VALOR OIL FILTER.

Used by the principal Electric Light Stations, Gas Engine Makers, Engineering Works all over the U.K. The VALOR Patent Oil Filter works 24 hours a day. Its savings increase until they equal its cost—and then it keeps on saving and becomes a profit earner.

Write to-day for fully descriptive free leaflet 401/V10.

THE VALOR CO. LTD.,

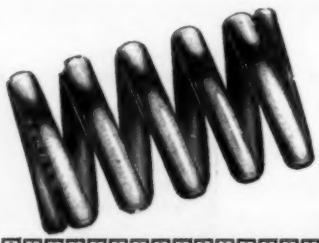
Valor Works, Bromford, Erdington, BIRMINGHAM.

LONDON: 120, Victoria St., S.W.1.

Buy British Goods.

VALOR OIL FILTERS

Trade Mark.



Why Terry's Springs Cost LESS.

They have "mettle"—that inherent quality which gives the spring its life—both in time and accuracy of action.

Tempering processes, based on over 70 years' experience—aided by the latest scientific instruments and processes—determines and safeguards "Terry" quality.

Buy "Terry" quality and get the service you require. We quote to print or sample—for producing any quantities in any metal. List free.

Herbert Terry & Sons, Ltd.,
Manufacturers,
Redditch, Eng.

Estab. 1855.

We can supply all types of washers, in any standard sizes from stock. Special sizes supplied in a few days. Ask for our prices.

WIDNES FOUNDRY (1925) LTD.

CONSTRUCTIONAL ENGINEERS.

TELEGRAMS: "FOUNDRY, WIDNES."

TELEPHONE: 225 WIDNES.

SPECIALISTS IN STEEL FRAMED BUILDINGS

BRIDGES, PIERS, WAREHOUSES, FACTORIES, THEATRES, CRANE GANTRIES, CRANE GIRDERS, TOWERS, TANKS, PRESSED STEEL WORK, TROUGHING, GUTTERS.

WORKS: WIDNES, LANCASHIRE.

LONDON: 38, VICTORIA ST., WESTMINSTER, S.W.1.

Telephone: 3190 VICTORIA (2 lines). Telegrams: "VILVALLE" LONDON.

HYDRAULIC AND SCREW LIFTING JACKS

FOR ALL PURPOSES.

WRITE FOR LISTS.

YOUNGS,

RYLAND STREET WORKS

BIRMINGHAM.

Telegrams: "OLDENS, BIRMINGHAM." Telephone: EDGBAS TON 2301

"Dead accurate"

ILLUSTRATION shows Vee-slide bracket, made to limits of half a thousandth of an inch, with the exception of the Vee-slide, which had to be cast dead accurate for a close sliding fit.

The manufacture of complicated die castings to close limits is a regular feature of our service.

PRESSURE DIE CASTINGS *in* White Brass, Tin Base, Lead Base, Aluminium Alloys.

GRAVITY DIE CASTINGS *in* Aluminium Alloys, Aluminium Bronze, Yellow Brass.

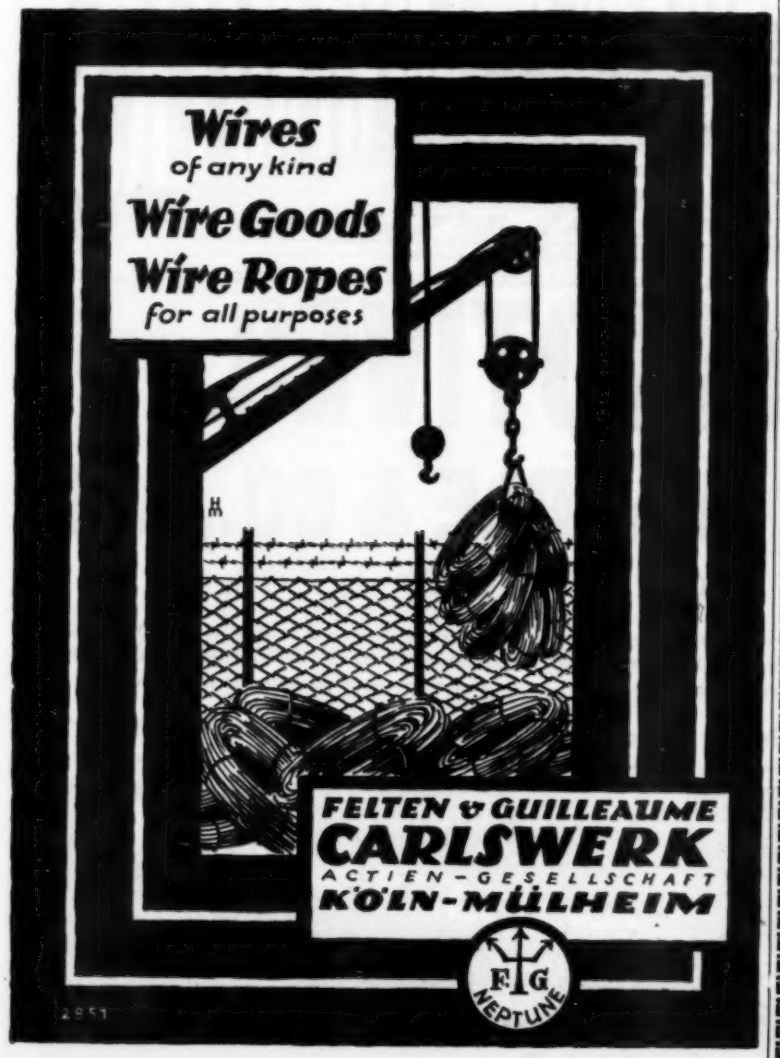
GENERAL FOUNDRY CASTINGS *in* Iron, Brass, Bronze, Aluminium and Nickel Silver.

FRY'S METAL FOUNDRIES, LTD.,

25-42, Holland St., Blackfriars, LONDON, S.E. 1.

Phone: HOP 4720.

MANCHESTER. BRISTOL. GLASGOW. DUBLIN.



KASENIT

NEW TYPE

REVERSIBLE NICKEL-CHROME ALLOY CASE HARDENING & BRIGHT ANNEALING BOXES

(PATENT APPLIED FOR).

ADVANTAGES:

1. Box packed in the ordinary way, turned upside down and luted before placing in the Furnace.
2. Avoids free escape of the Carbonaceous gases, thereby increasing the pressures.
3. Resulting in greater depth of penetration of the case in a shorter time, thus effecting great economy of fuel.
4. As the work is not exposed due to shrinkage of compound, there is no risk of spoiling the parts to be carbonised.
5. Made in various sizes to suit customers' requirements.

PRICES ON DEMAND.

KASENIT LTD.,

Henry Street, Bermondsey St., London, S.E. 1.

Ringhoffer - Koprivnice - Studenka.

RAILWAY ROLLING STOCK MANUFACTURERS.

Central Office for Export Trade:—
Prague—Smichov, Czechoslovakia.

Telegraphic Address:—
Exwaggon Prague—Smichov.

Agents in U.K.:—
Messrs. Carters, 6, Princes St., E.C. 2.

MANUFACTURE.

Passenger-carriages and goods wagons of every description, for normal or narrow gauge, saloon-cars, sleeping-cars, dining-cars, tramway-cars, electric and other motor-coaches, tenders, refrigerator-vans for the transport of beer, milk, meat, fish, etc., boiler trucks for heating, tank-wagons for petroleum, alcohol, molasses, sulphuric acid, etc., inspection trolleys, snowploughs, wagons for camp railways, ambulance cars for hospital-trains.

BRICK MACHINERY

BENNETT & SAYER

Engineers, Ironfounders and General Millwrights,

DERBY.

BERTRAMS LIMITED
SCIENNES EDINBURGH
Paper Mill Machinery

STONEBREAKERS

Crushing Rolls,
Screens, Elevators and Conveyors.
Complete Plants for Fine Crushing or Macadam are our Speciality.

ROBERT BROADBENT & SON, Ltd.,
Phœnix Ironworks, STALYBRIDGE.
Telephone No. 256. Tel. Address—Broadbent, Stalybridge

Heating and Ventilating

DUST EXHAUSTING, DRYING, &c.,
EXPERTS. KEEN PRICES.

W. E. BROWNING & CO.,
Cowley Works, Laytonstone, E.

PUMPS FOR LAND & MARINE PLANTS
DAWSON & DOWNIE LTD. CLYDEBANK.
See illustrated advt.

GRAIN, CHILL & STEEL ROLLS
HEAVY CASTINGS Iron up to 100 tons Steel up to 40 tons.
Cast Steel Loco. Wheel Centres a Speciality.
R. B. TENNENT, LIMITED,
COATBRIDGE, N.B.

ROBERT STEPHENSON & CO. LTD
Locomotive Builders, DARLINGTON.
London Office - 25, VICTORIA STREET, WESTMINSTER.
LOCOMOTIVES for all Gauges and Services.
Telegrams: Rocket, Darlington; Altiscope, London.
Nat. Tel.—2700 Darlington; 650 Victoria.
Codes: A B C, 5th Edition. Engineering Standards, Engineering Telegraph.

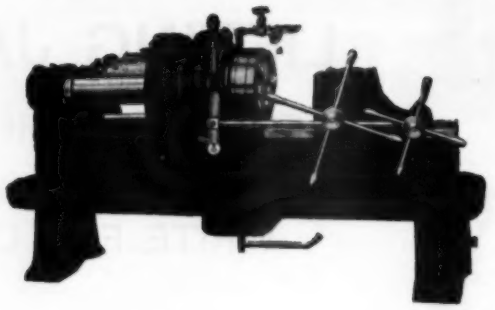
BRITISH ROPEWAY ENGINEERING Co., Ltd.,
14-18, HOLBORN, E.C. 1.
Tele.: HOLBORN 0755 (2 lines).
Telegrams: BOXHAULING SMITH-LONDON.
SEE ILLUSTRATED ADVT. LAST & NEXT WEEK

BROWNLIE & MURRAY, LTD
STRUCTURAL ENGINEERS
POSSILPARK, GLASGOW.
See Illustrated Advertisement last and next week

See Illustrated Advertisement last week and next.
SMITH'S RELIABLE CRANES
Thomas Smith & Sons (Rodley), Ltd., nr. Leeds

The Best—and British Throughout.

HEAP'S PATENT SCREWING MACHINES with tangential dies,



are the last word in Screwing Machines. They are designed from beginning to end as high class Machine Tools and embody features not found in any other make of Screwing Machine.

The Die Head is of entirely new design and Patents have been applied for.

The Tangential Dies are thread milled and hardened. When dull they can be simply re-ground and are then equal to new. They never require re-hobbing.

Responsible representatives of firms interested are invited to visit our Works to inspect the Machines in construction and completed, test them in actual use and prove their capabilities.

Joshua Heap & Co., Ltd., Ashton-under-Lyne, England.

LOCOMOTIVES.

MANNING, WARDLE & CO., LTD.

BOYNE ENGINE WORKS, LEEDS.

Makers of Locomotive Engines for any width of gauge and various purposes. Also makers of Internal Combustion (Petrol) Locomotives Materials and workmanship of the best quality. Tank Engines up to 18in. cylinders, on four or six wheels, always in stock or in progress. Specifications, Photos and Prices on Application, and special designs sent on receipt of particulars of requirements.

LONDON OFFICE: Mr. H. J. Heagerty, 34, Victoria Street, Westminster, S.W. 1.

The BIRMINGHAM BATTERY & METAL Co. LTD
SELLY OAK, BIRMINGHAM
SEAMLESS AND BRAZED
BRASS AND COPPER TUBES
BRASS AND COPPER
RODS, SHEETS, WIRE &c.
LOCO TUBES, CONDENSER TUBES, PLATES, FERRULES, &c.
TELEGRAMS BATTERY SELLY OAK
TELEPHONE 151 (3 LINES) SELLY OAK

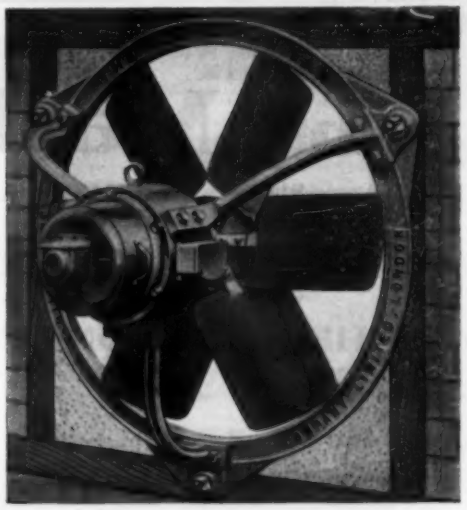
Keith-Blackman FANS *for every purpose!*

The fan illustrated is a Patent Streamline "Blackman" with electric motor. These propeller fans are made in various types and sizes and form a ready and inexpensive means of ventilating buildings and rooms or departments of buildings. See our "Fan" Catalogue No. VI.

BLACKMAN AIR PROPELLER

TRADE MARK

If your problem necessitates movement of air or gas, or the removal of smoke, steam or fumes, put it up to us.



JAMES KEITH & BLACKMAN Co LTD

Head Office: 27, Farringdon Ave., London, E.C.4.

MANCHESTER: 4, Cannon Street. BIRMINGHAM: 21, Waterloo Street. LEEDS: 36, Royal Exchange. GLASGOW: 90, Mitchell Street.
And at Newcastle, Cardiff, Sheffield, Bristol and Belfast.

Weldless Steel Flanges for Hydraulic, Steam and Oil Pipe installations, also large flanges up to 5 ft. 0 in. diameter for Hydro-pipe Lines.

Apply to

Charles McNeil Ltd.
Kinning Park Hydraulic Forge,
Glasgow.

Telegrams : "McNeil, Glasgow."
Telephone : Glasgow, Ibrox, 820.

Agents for London and South East of England :
Charles McNeil & Company, 199, Piccadilly,
LONDON, W. 1.
Telephone : Regent 5138.
Telegrams : "Managerial, Picc, London."

BUILT FROM A SINGLE TESTED STRAND

For Economical Power Transmission
HENDRYS' LAMINATED BELTING
REG. TRADE MARK

GLASGOW: 252, Main Street, Bridgeton, Glasgow. 'Grams: "Laminated, Glasgow" 'Phone: Bridgeton 1747 (3 lines).

LONDON: 16, Union Court, Old Broad Street, London, E.C.2. Grams: "Cheveral, Stock, London." Phone: Central 4638.

BIRMINGHAM: Empire House, Great Charles St., Birmingham. 'Grams: "Horsepower, Birmingham." 'Phone: Central 3443.

MANCHESTER: 3, Palmerston Avenue, Whalley Range, Manchester. Phone: Chorlton 846.

JAMES HENDRY LIMITED

WRITE FOR FULL PARTICULARS AND PRICES.

SPONGE CLOTHS
FOR ENGINEERS
Joshua Hoyle & Sons Ltd
Cotton Spinners and Manufacturers
50, PICCADILLY, MANCHESTER
Wholesale and Shipping only

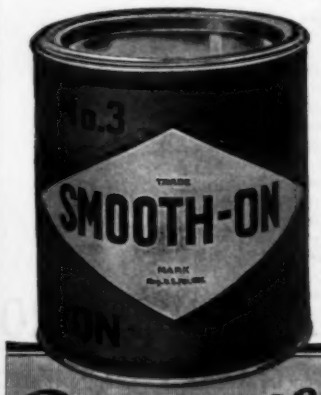
AWP

ELECTRIC ARC WELDING.

Electrodes and Plant supplied for all classes of work.

ALLOY WELDING PROCESSES, Ltd.,
14-16, Church Street, London, N.1.
Telegrams: Alweprol, Nordo, London. Telephone: Clerkenwell 8650.
See our large Illustrated advt. alternate issues with this.

Make joints like this *leakproof*
—and have one thing less to worry about!



THERE are no leaks—and never will be—in pipe joints laid up with Smooth-On No. 3 because the metallic body in Smooth-On is *permanently* impassable under any pressure or temperature and with any fluid.

Smooth-On No. 3 fills every minute void and its volume never decreases, because the metallic body can't shrink, dry out, shrivel or crack.

Get it in 1 or 5 lb. gray-labeled cans from any supply house.

Write for the free Smooth-On Handbook.

Distributed by Walter P. Notcutt, Ltd., 8, White Street, Moorfields, London, E.C., and carried in stock by leading dealers and supply houses.

Made by Smooth-On Mfg. Co., Jersey City, N.J., U.S.A.

Do it with SMOOTH-ON

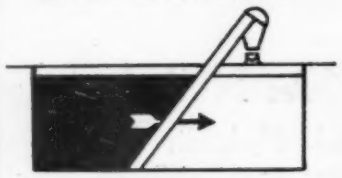
Coal Handling by Machinery

SIMON PNEUMATIC AND MECHANICAL COAL HANDLING APPLIANCES.

Reduce cost of handling. Eliminate waste effort. Give increased efficiency.
Speed up the actual handling process. Save labour. Solve conveying problems.

HENRY SIMON LTD., MANCHESTER.
Please write to: CONVEYING DEPT., CHEADLE HEATH, Stockport.

F. W. BRACKETT & Co. Ld.
ENGINEERS, COLCHESTER.



SPECIALISTS IN
SCREENING PLANT
For WATER, SEWAGE, Etc.,
FILTRATION & PURIFICATION
OF WATER SUPPLIES, WORKS EFFLUENT, ETC.
Makers of PUMPS, AIR COMPRESSORS, Etc.

STEAM TRAPS AND THERMOSTATS FOR ALL PURPOSES.

THE HORNE ENGINEERING CO.
35, Pitt St.,
GLASGOW.

See the Mark?
The famous diamond trade mark which has made Jenkins and Valves synonymous terms throughout the world. Look for the mark when buying—it means valve efficiency for you.
No. 90, Catalogue post FREE.
JENKINS BROS. LTD.
(Dept. 2), 6, Gt. Queen Street, W.C.

Permac
JOINTING MATERIAL
PERMAC JOINTS RESIST HIGHEST PRESSURES
PERMAC JOINTS DO NOT BLIST
EASILY REMOVED WHEN REQUIRED

THOMAS & BISHOP LTD
EXTABERNACLE ST. LONDON, E.C.2

CRANE
VALVES & FITTINGS
Heating, Sanitary & Oil Engineers' Supplies.
CRANE-BENNETT LTD.,
Head Office & Warehouses:
45-51, LEMAN STREET, LONDON, E. 1.

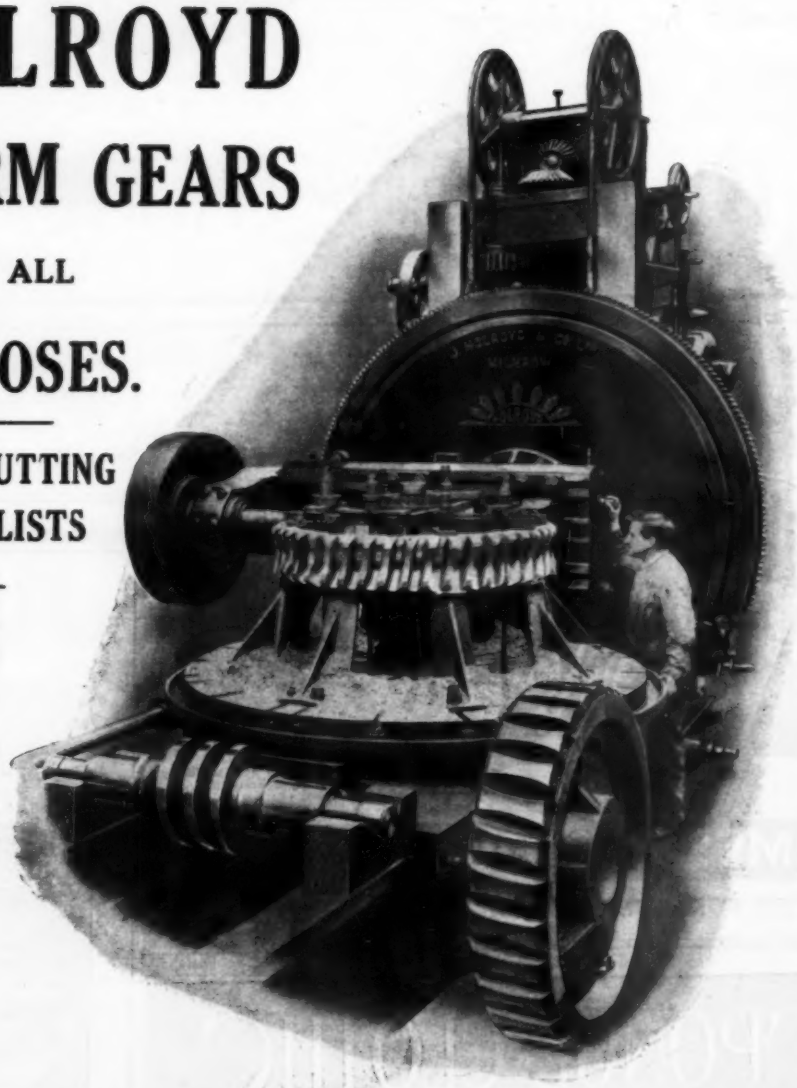
STONE AND COAL **CRUSHERS** ENG.
LEICESTER
GOODWIN BARSBY & Co

HOLROYD

HOLROYD WORM GEARS FOR ALL PURPOSES.

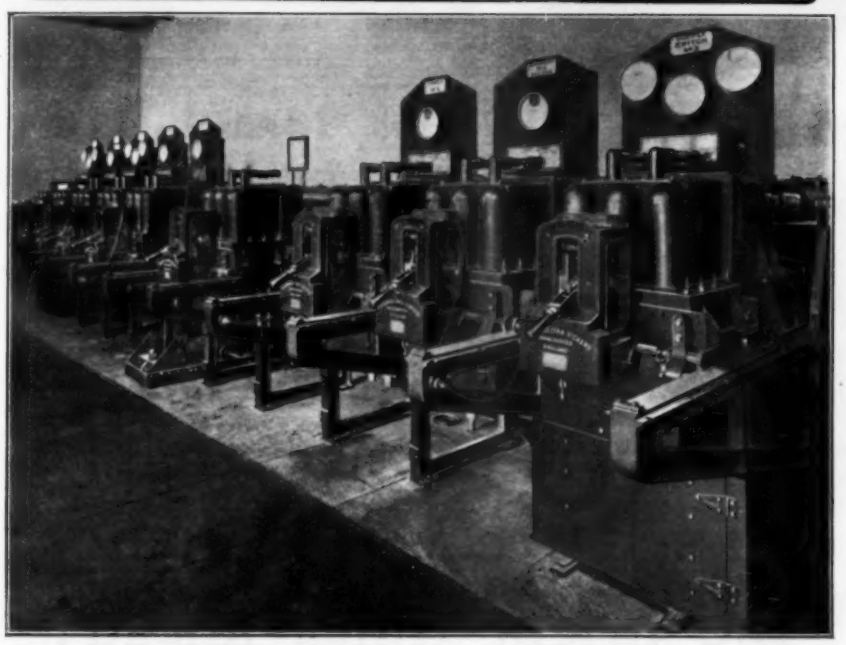
GEAR-CUTTING SPECIALISTS

SEND US YOUR ENQUIRIES



JOHN HOLROYD & CO., Ltd., Milnrow, Lancs.
MAKERS OF MACHINE TOOLS TO INCREASE PRODUCTION.

K SWITCHGEAR at CLYDE VALLEY



The illustration shows a "Metrovick" type "K1" Metalclad Switchgear for 11,000 volts, installed by the Clyde Valley Electric Power Co. This is typical of "Metrovick" Metalclad switchboard installations in many other supply stations throughout the country and abroad.

"Metrovick" K type Metalclad Switchgear is designed for circuits up to 35,000 volts and for rupturing capacities up to 1,500,000 kVA. They can be arranged for single or duplicate busbars and built up to any size of switchboard. All live parts are either immersed in oil or embedded in compound.

K Switchgear is compact, dust-proof, vermin-proof and equipped with a complete system of interlocks and automatic indicating devices. When switches are withdrawn they are completely isolated and the plug sockets automatically screened.

Send for Circular 1292/1.

METROPOLITAN Vickers ELECTRICAL CO. LTD
TRAFFORD PARK MANCHESTER

F
K08

BOBY

WATER SOFTENERS HEATERS FILTERS

WILLIAM BOBY & CO., LIMITED,

64, Brook Street, Grosvenor Square, London, W. 1.

Superior Castings!
Wallwork

HENRY WALLWORK & CO., Ltd., MANCHESTER

Easton & Anderson

Proprietors:
The Fulcometer Engineering Company, Ltd.

Pumping Machinery

for Sewage and Water Works.
11, Tothill Street, LONDON, S.W.
Works: READING.

Wm MILLER & SONS LTD.
WOLVERHAMPTON.

LOWEST PRICES ON APPLICATION.

Dust Proof, Ball Bearing Grinding and Polishing Machines

Will outlast all others.
Makers of Plain and Universal Grinding Machines for all Purposes.
Send us your Enquiries.
MORTON & WEAVER, The Tool Makers, COVENTRY.

THE MOTHERWELL BRIDGE & ENGINEERING CO., LTD.

ENGINEERS & CONTRACTORS,
BRIDGES, ROOFS, PIERS, TANKS, DOCK GATES
Hydraulic Pressed Flooring, etc.
Telegrams: "Bridge." MOTHERWELL, N.B. Tel. Nos. 40 & 41.
London Office: 82, Victoria Street, S.W. 1.
Telegrams "Mobricolm" Sowest. Tel. No. 4153 Victoria.
See illustrated advt. last and next week.

Hydraulik G.m.b.H. Duisburg.

Hydraulic presses and apparatus.
Water-power plant for all branches of industry
Representatives:
Aabaosa Engineering Co., Ltd., Canning Place, Liverpool.

USE **GRABS**

For handling materials in bulk, COAL, COKE, SAND, GRAVEL, etc. etc.

GRABS of all kinds, Double and Single Chain, made by:—
ROSE, DOWNS & THOMPSON, LTD.
Old Foundry, HULL.

USE **GRABS**

TROUGH FLOORING

BLOCKS OF ALL DESCRIPTIONS in Stock.

Pressed in lengths up to 40 ft. *Send for SECTION LIST.*

THE
TEES-SIDE BRIDGE & ENGINEERING WORKS
LIMITED
MIDDLESBROUGH.

Telegraphic Address: "TEESSIDE" Middlesbrough
Telephone: Nos. 21 and 22

LONDON OFFICE: 17 Victoria Street, S.W. 1.
Telephone: Victoria 4043.

Fuel-Gas
FOR INDUSTRIAL HEATING PURPOSES

Results in:
REDUCED COSTS,
CLEAN CONDITIONS,
INCREASED OUTPUT.

THE POWER-GAS CORPORATION, LIMITED,
PARKFIELD WORKS,
STOCKTON-ON-TEES.

BEARDMORE

STEEL MANUFACTURERS, FORGE MASTERS, SHIPBUILDERS, ENGINEERS
MARINE, LOCOMOTIVE, AUTOMOBILE, AERONAUTICAL & GENERAL ENGINEERS

DOUGLAS FRASER & SONS, Ltd.,
ARBROATH
MILL GEARING, BELT PULLEYS, & ROPE PULLEYS.
See Illustrated advt. June 10th, page 58.

BRETTS PATENT LIFTER Co LTD
SPECIALISTS IN
DROP-FORGING EQUIPMENT
FOLESHILL WORKS COVENTRY.

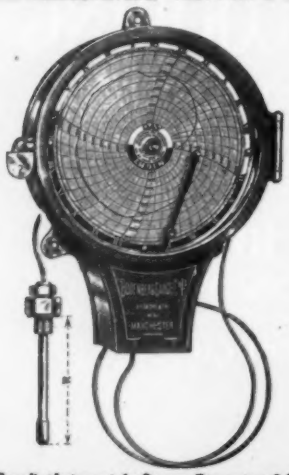
MICHELL BEARINGS, Ltd.,
ENGINEERS & MANUFACTURERS OF
Michell Thrust & Journal Bearings
Registered Office and Works:
South Benwell, Newcastle-on-Tyne.
See large Advertisement page 51, Dec. 3rd.

Briquette Machinery
FOR
COAL, COKE, ORES, &c.
WRITE:—
HERBERT ALEXANDER & CO., LTD.
Charmouth Street, Leeds.

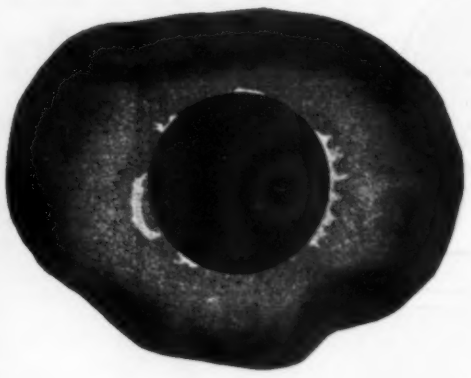
£50 SMOKE FINE ON
JULY 1st. NO NEED TO FEAR THIS IF YOU FIT THE
MELDRUM SMOKE CURE FURNACE.
Address: TIMPERLEY, MANCHESTER.

SCRIVEN & Co (LEEDS) LTD
MACHINE TOOLS
'PHONES: 21830 21831
'GRAMS: SCRIVEN, LEEDS.
YORK ST IRONWORKS, LEEDS.

BUDENBERG GAUGE CO., LTD.
Broadheath, Nr. Manchester,
Branches: LONDON & GLASGOW.
MAKERS OF
PRESSURE GAUGES,
TACHOMETERS, COUNTERS,
DIAL-THERMOMETERS, TEST-PUMPS &c.



Self-Recording Instruments for Pressure, Temperature, & Speed



From a PHOTOGRAPH OF THE TOTAL ECLIPSE OF 1919 TAKEN IN BRAZIL.

The eclipse of next week will come and pass. The long continued eclipse of trade will just as certainly pass. Are you ready for the bright times ahead? Send your enquiries for Planers & Boring Mills to:

JOHN STIRK & SONS LTD.
HALIFAX.

Use it in your Works

TECALEMIT
HIGH PRESSURE LUBRICATING SYSTEM
is being widely adopted by users of machinery of all kinds requiring either oil or grease lubrication.
Tecalemit renders Grease cups obsolete, and by means of pressures up to 5,000 lbs. per sq. inch forces lubricant right into the places where it is needed in a simple, clean and efficient manner.
OVER 600 Manufacturers of Motor Cars, Lorries, Tractors, Locomotives, Steam Rollers and Machine Tools, fit Tecalemit as Standard Factory Equipment.

Telephone Numbers: Mayfair 4143, 4, 5.
TECALEMIT LTD., *Lubrication Experts,*
10, LITTLE PORTLAND STREET. LONDON, W. 1.

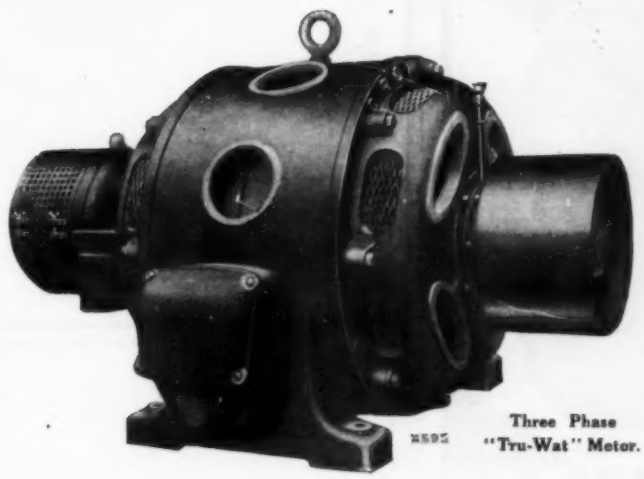
REDUCE YOUR RUNNING COSTS

by installing CROMPTON (PATENT)

"TRU-WAT"

THREE PHASE MOTORS
WHEN PAYING FOR POWER ON A k.V.A. BASIS

Simplest Synchronous Motor constructed. Starts as an Induction Motor. Only requires ordinary Switch and Starter. Unity or leading Power Factor.

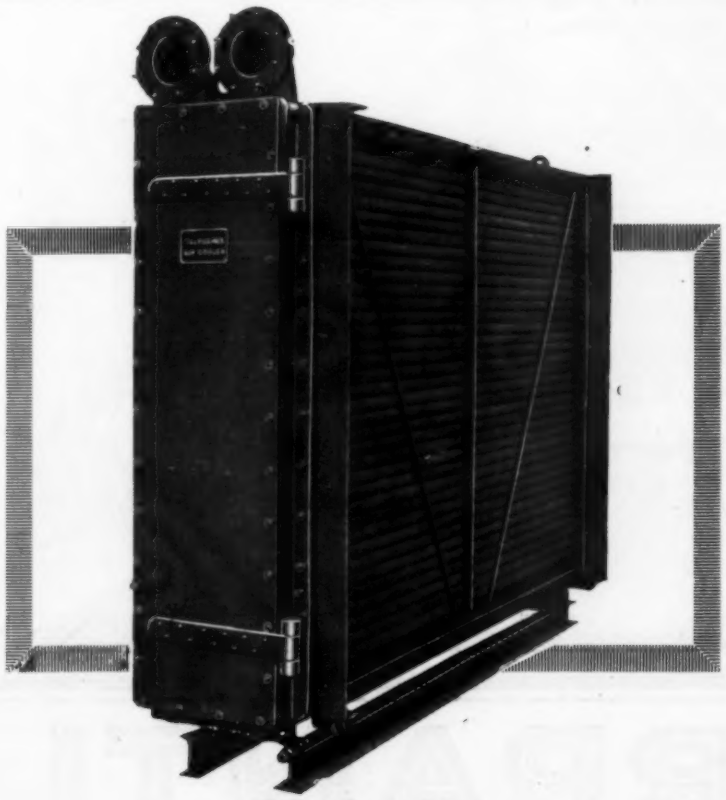


Three Phase "Tru-Wat" Motor.

Telephone: Chelmsford 161

CROMPTON & CO LTD
CHELMSFORD ENGLAND

Telegrams: Crompton, Chelmsford



Made by

THE PREMIER COOLER & ENGINEERING CO., LTD.,
Shalford, Near Guildford, Surrey.

The PREMIER CLOSED CIRCUIT AIR COOLER

(Patented)

A great asset to turbo-alternator efficiency.

The design of this unit allows condensate to function as cooling medium, thus conserving considerable heat, and dispensing with constant tube cleaning.

Excessive temperature rise in the alternator is prevented by the automatic emergency air-inlets.

All air being completely enclosed ensures absolute cleanliness and makes Filters unnecessary.

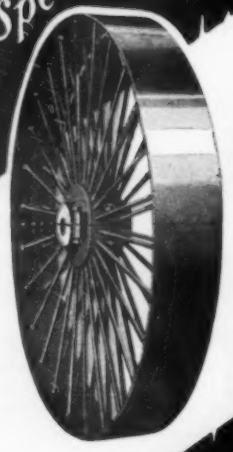
An investigation of the Premier Closed Circuit Air Cooler will reveal many features of the greatest interest to Engineers. Convincing proof of their efficiency is evidenced by the steadily increasing number of installations (over 400,000 K.W. have been installed to date).

Please write for interesting Booklet. Dept. E.W.

Wrought Iron Belt

PULLEYS

a Sole Speciality



DOUGLAS & LAWSON LD.

BIRSTALL NR. LEEDS

Telephone: BATLEY 598 & 599

Telegrams: "PULLEYS, BIRSTALL."

Write for new 1927 150 pp. illustrated catalogue with discounts.

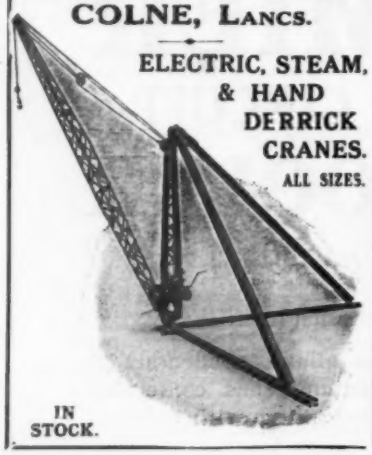
RUSHWORTH BROS. LTD.

PRIMET BRIDGE WORKS,

COLNE, LANCS.

ELECTRIC, STEAM, & HAND DERRICK CRANES.

ALL SIZES.



IN STOCK.

The COIL CLUTCH CO., Ltd.,

Phœnix Works, Johnstone, Scotland.

Manufacturers of

COIL FRICTION CLUTCHES

For all Purposes, Powers and Speeds

Quotations and Designs supplied on receiving particulars of application.

See Illustrated Advertisement last week & next.

CLYNE ENGINEERING CO. LD.

WATER COOLERS. CONDENSING PLANTS.

VACUUM PUMPS & COMPRESSORS.

STEAM TRAPS, &c.

Telephone: 4070 City. Telegrams: Modernise, Manchester

94, MARKET STREET, MANCHESTER.

T. DAVIES & SON.

RAILWAY IRON WORKS,

WEST GORTON, MANCHESTER.

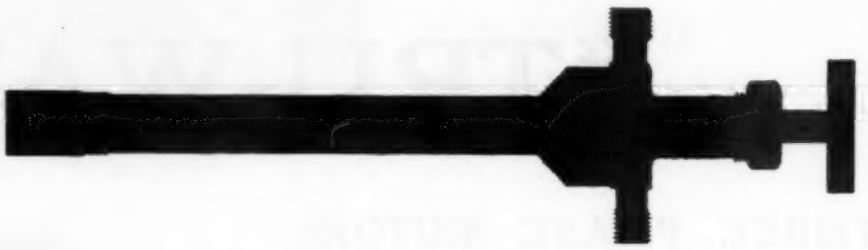
CUPOLAS & LADLES.

PERFECT ATOMIZATION IS OF FIRST IMPORTANCE.

OIL BURNERS.
LAIDLAW, DREW & Co.,
SIMON SQUARE,
EDINBURGH.

NO SMOKE AND NO COKING OF THE FLUES.

EASE OF LIGHTING.



EASE OF CONTROL.

EASE AND WIDE RANGE OF ADJUSTMENT.

ILLUSTRATED BOOKLET AND PRICE LIST ON APPLICATION.

ABILITY TO SHAPE FLAMES AND "FIT" ANY BOILER.

FERRANTI

TRANSFORMERS

FERRANTI ELECTRIC LIMITED TORONTO, CANADA

FERRANTI LTD. HOLLINWOOD ENGLAND

FERRANTI INC. 130 W. 42nd ST. NEW YORK, U.S.A.

WE ARE THE ACTUAL MAKERS OF

FANS

CAN WE QUOTE YOU FOR FANS FOR ANY OF THE FOLLOWING USES:

INDUCED DRAUGHT.
FORCED DRAUGHT.
FUME REMOVAL.
DUST REMOVAL.
WOOD REFUSE REMOVAL.
VENTILATING.
HEATING.
DRYING.
SHIPS' FANS, ALL KINDS.
SINTERING.
BLAST FOR HEARTHS.
BLAST FOR CUPOLAS.
BLAST FOR OIL & GAS FUEL.
MINE FANS.
SPECIAL PURPOSES.

FOR ALL PURPOSES.

We are well equipped for the manufacture of fans of every kind and size, and our experts are at your service, backed by extensive experience in fan design and application.

Your enquiries for any of our standard fans, or for any special design to meet your requirements, will have our prompt and careful attention.

NEW ALLDAYS & ONIONS, LTD.

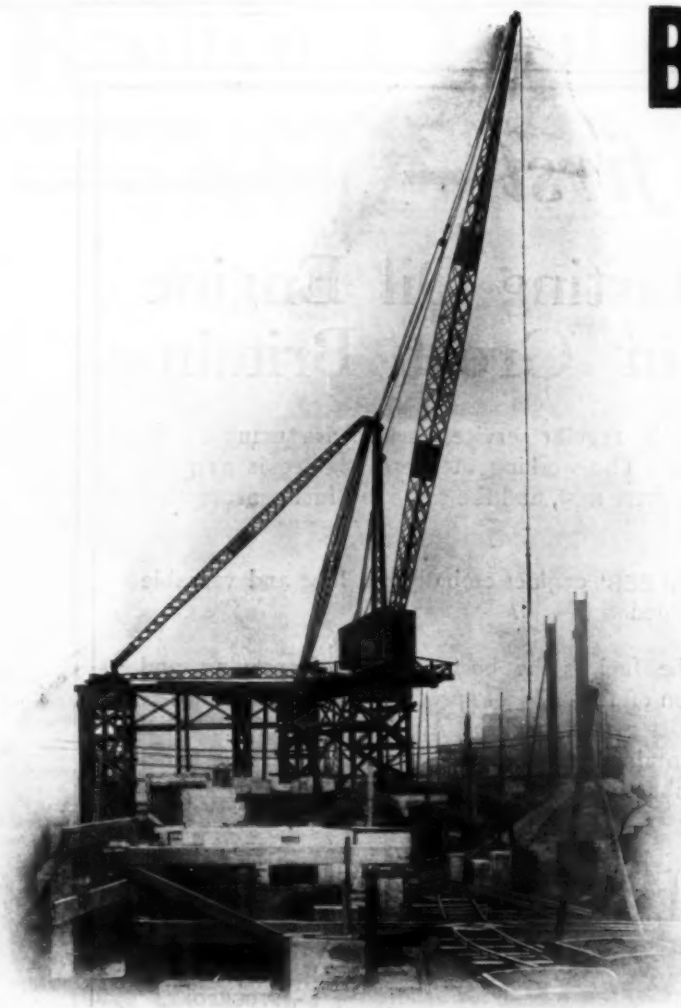
(Alldays & Onions and Thwaites Bros.),

GREAT WESTERN WORKS, BIRMINGHAM.
Teleg.: 'Alldays.' 'Phone: Vic. 487.

9, VICTORIA STREET, LONDON.
Teleg.: 'Typhoon,' Sowest. 'Phone: 6137 Vic.

WE ARE ALSO MAKERS OF, AND SHALL BE PLEASED TO QUOTE FOR:

BLOWERS. Roots' & "Empire" for High and Low Pressures.
FURNACES for Oil, Gas & Coal.
CUPOLAS & Charging Machines (Thwaites Types).
LADLES of all sizes.
STEEL CONVERTERS. Sole Manufacturers of "Stock" Patent Converter.
POWER HAMMERS. Pneumatic and Steam.
SMITHY & FOUNDRY EQUIPMENT.



BUTTERS BROS. & Co.

Percy Crane Works,

GLASGOW.

LONDON OFFICE:
SENTINEL HOUSE, SOUTHAMPTON ROW,
LONDON, W.

MAKERS OF ALL TYPES OF

CRANES

AND

HOISTING MACHINERY.

Cables and Telegrams: **BUTTERS, GLASGOW.**
BUTACRANES, WESTCENT, LONDON.

'Mirrlees'

Delas-Ginabat CONDENSER

This remarkable Condenser requires 25 to 30 per cent. less cooling surface than others. The condensate temperature is several degrees higher than the inlet steam.

■ ■ ■

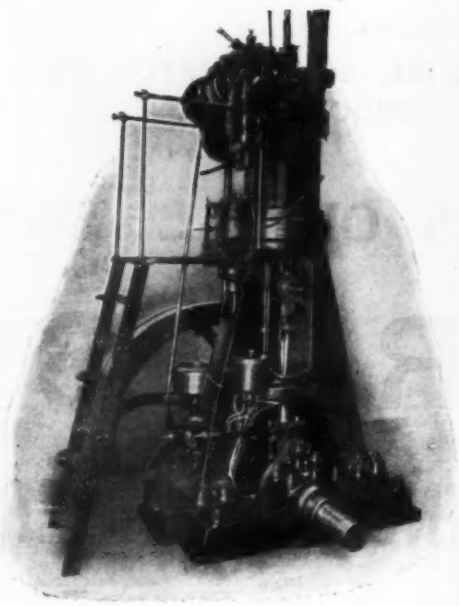
Write us for information on the astounding performances of this Condenser.

The MIRRLEES WATSON COMPANY LIMITED
ENGINEERS GLASGOW.
45, Scotland Street,
London Office: 7, Grosvenor Gardens, S.W. 1.

264

This was the first —

Cold Starting Oil Engine Made in Great Britain.



Built in 1897.

It is still working in regular service, as also are many others 15 to 20 years old. The working of these engines is as good to-day as when they were new, and the same low fuel consumption is maintained.

The present **'MIRRLEES'** engines embody the long and valuable experience thus gained.

Air injection of the fuel is the best method of spraying, and meets wide variation of fuel oils, of speed, and of load conditions without any alteration of nozzles. Air injection of the fuel ensures long maintained economy of working with the most complete fuel combustion.

MANUFACTURED BY

MIRRLEES, BICKERTON & DAY, LTD.

7, Grosvenor Gardens, LONDON, S.W. 1.

Hazel Grove, Nr. STOCKPORT.

TESTING FOR HARDNESS

The Avery N°691 Patent Hardness Testing Machine.

This is an apparatus for measuring the hardness of metals. It is eminently suitable for carrying out the standard Brinell test in which a 10 mm. diameter steel ball in contact with the specimen is loaded with a pressure of 3000 kgs.

In addition the accuracy and sensitiveness of the machine is such that by using very light loads in conjunction with balls of small diameter, minor Brinell tests can be carried out with equal confidence. This is possible only because the design is based upon true weighing principles which also permits of calibration by standard dead weights.

Write for list 701.

AVERY

W & T. AVERY Ltd SOHO FOUNDRY BIRMINGHAM

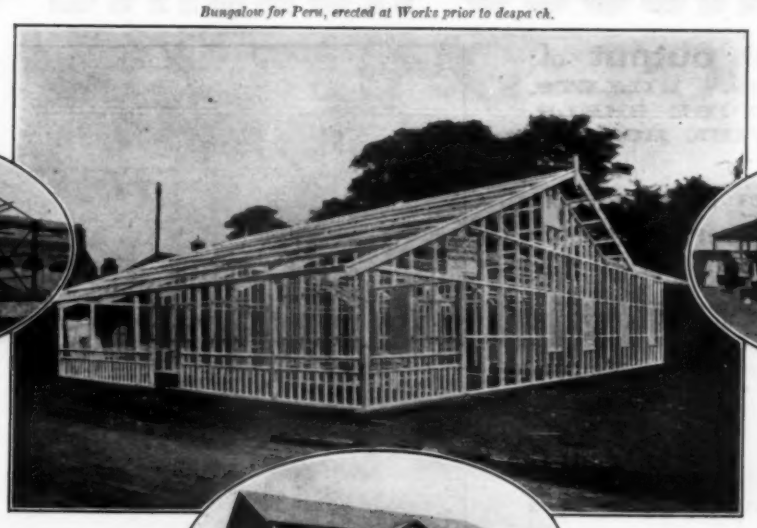
Ad 1482

Boulton & Paul Buildings for Export

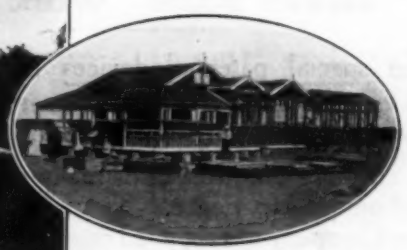
WOOD : COMPOSITE WOOD & STEEL : STEEL

Nearly 1000 Recently Exported.

Bungalow for Peru, erected at Works prior to despatch.



Steel Building for Belgian Congo.



Bungalow in course of erection for Government of Sudan.

Staff Quarters' Bungalow, Loanda Railway.

Designs and estimates given for any requirement.

ASK FOR CATALOGUE No. 711.

Codes used:

A.B.C (6th Ed.), Lieber's, Western Union, Bentley's, Scott's, Engineering (2nd Ed.), Marconi, McNiell's (1908 Ed.) and Private.

Also makers of the
BOULTON WATER ELEVATOR
A wonderful invention for raising well water
Ask for Catalogue No. 713.

A few Contracts where Boulton & Paul Buildings were used:

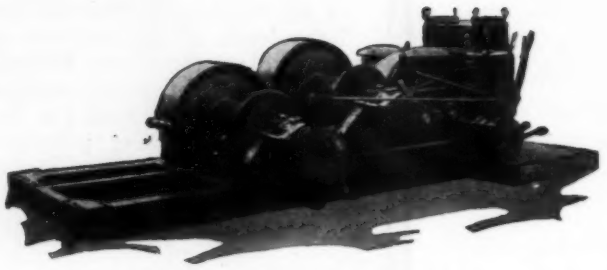
Uganda Railway.
Loanda Docks.
Radio Co. Stations, West Indies.
Benguela Railway.
Santos Docks, Brazil.
200 Bungalows, Angola.
Residences for Government of Jamaica,
etc. etc.

Boulton & Paul Ltd. will at any time be pleased to receive for publication photographs of Bungalows, Factories or any other type of building supplied by them.

Boulton & Paul Ltd

Cable address: "BOULTON NORWICH ENGLAND" NORWICH. Eng. London Office: 139-140 QUEEN VICTORIA ST. E.C.4.

"ZENITH" FRICTION WINCHES



2-Drum "Zenith" Electric Winch, with provision for adding 3rd Drum.

Whilst the initial cost of machinery has to be studied, what is of greater importance is "running charges"; the cost per H.P. generated, or, in the case of haulage gear, the lifting cost per ton. It is because we have been able to satisfy Engineers of the high efficiency of "Zenith" Friction Winches, that these are used in such large numbers throughout the world.

For simplicity of design, for sheer ruggedness and strength, "Zenith" Winches are unrivalled. Rated well within their capacity they can always be relied upon to deal with reasonable overloads in perfect safety.

"Zenith" Winches are made in sizes from 1-8 tons load; rope speeds up to 800 feet per minute. Drives: Steam, electric, crude oil and petrol. See our Winch list No. 113, post free on request.

If you wish to operate a Guy-Derrick, Dragline, Cableway or Piledriver, get a "Zenith" Winch.

The British Steel Piling Co. Ltd.

WORKS: CLAYDON, SUFFOLK. 54a, Parliament Street, Westminster, London, S.W. 1.

E.I.H.

"MORGAN" CONTINUOUS ROLLING MILLS

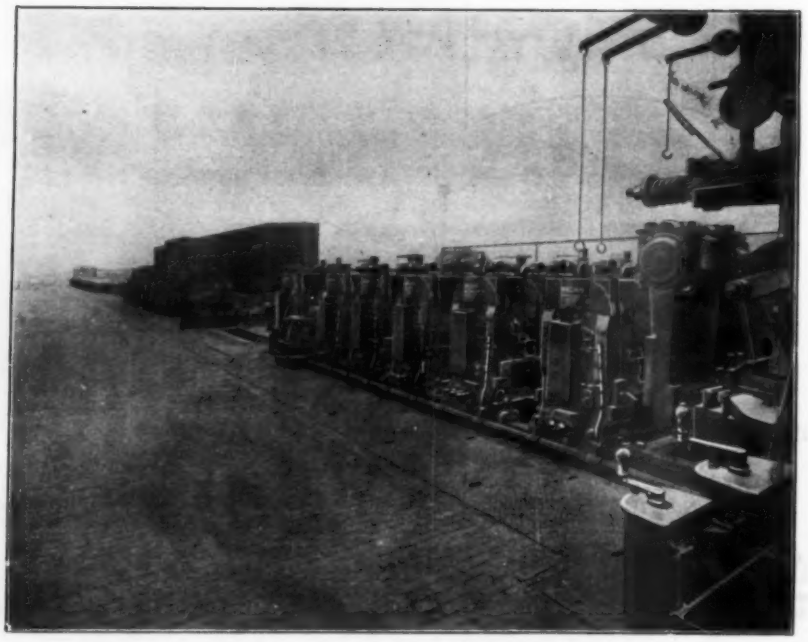
are essential for **highest output** of:
MERCHANT SECTIONS. BILLETS. HOOP AND STRIP. TUBE SKELP. SHEET BARS. WIRE ROD.

The special patented devices incorporated in these mills ensure conversion costs very much lower than with any other type of mill.

They are the product of many years' research and unique experience. The Morgan Construction Company has supplied most of the continuous mills throughout the world, totalling to date 145.

A number of installations, built by us to the designs of the Morgan Company, have been set to work in England in the last few years with most successful results.

We are Sole Agents and Manufacturers for "Morgan" Continuous Rolling Mill Plants for Great Britain and many other countries.



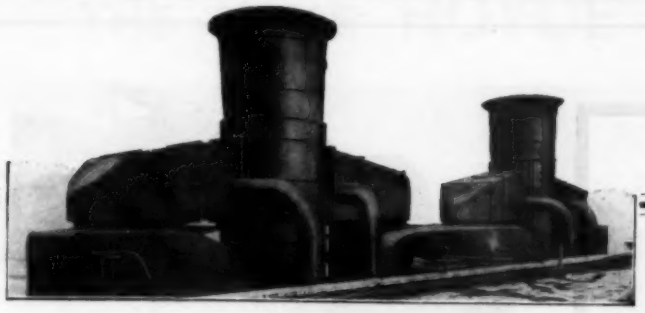
"MORGAN" CONTINUOUS STRIP MILL
Installed in England.

DAVY BROTHERS LTD.,
SHEFFIELD.
Established 1830.

Telephone
Sheffield 22161 (5 lines).

Telegrams
Motor, Sheffield

We are also specialists in :—
COGGING, PLATE, BAR, SECTION and TYRE MILLS.
STEELWORKS MACHINERY, HYDRAULIC MACHINERY.
HIGH-SPEED STEAM HYDRAULIC FORGING PRESSES.
STEAM HAMMERS, STEAM BOILERS.



Achievement

FOR definite results in the abolition of the dust nuisance, the DAVIDSON PATENT FLUE DUST COLLECTOR stands supreme. The actual achievements of this Collector in a large number of Power Stations have given ample proof of its superiority.

TRADE SIROCCO MARK

Send for Our "ACHIEVEMENT" CATALOGUE No. 23.

DAVIDSON & Co. LIMITED
SIROCCO ENGINEERING WORKS - BELFAST

LONDON: Central House, Kingsway, W.C. 2.
MANCHESTER: 54, Corporation Street.
GLASGOW: 53, Bothwell Street.
BIRMINGHAM: Exchange Buildings, New Street.
CARDIFF: Principality Buildings, Queen Street.
BRISTOL: 61, Victoria Street.
NEWCASTLE-ON-TYNE: 4, St. Nicholas' Buildings.

REDMAN

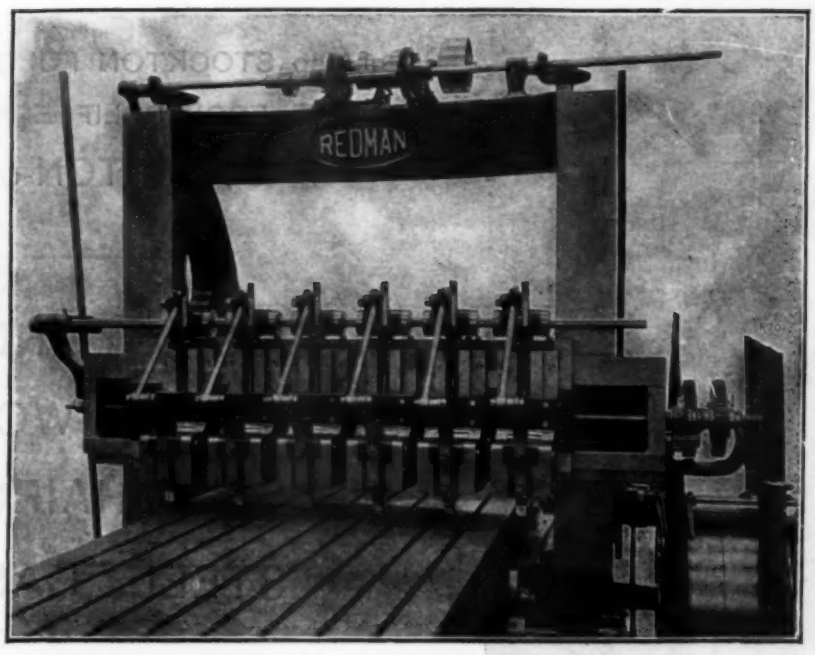
DOUBLE CUTTING TOOL BOX

Patent No. 261,243.

Photo illustrates our Redman-Binns Double Cutting Tool Box.

This has been tried out in our own Works and has proved eminently satisfactory.

Come and see it in operation at our Works.



INCREASED OUTPUT

GREAT SAVING IN POWER.

IN MOST CASES EXISTING MACHINES CAN BE FITTED.

SEND US PARTICULARS OF YOUR WORK AND LET US TELL YOU MORE ABOUT THE DOUBLE CUTTING BOX.

C. REDMAN & SONS, LTD., GIBRALTAR, HALIFAX.

'Phone: 308 Halifax. Telegrams: "Planers, Halifax."

FULLERTON HODGART, & BARCLAY, LTD
:: PAISLEY ::

Telephones: 2163-4 Paisley (Private Branch Exchange).
Telegrams: "Vulcan, Paisley."

ESTD. 1838.

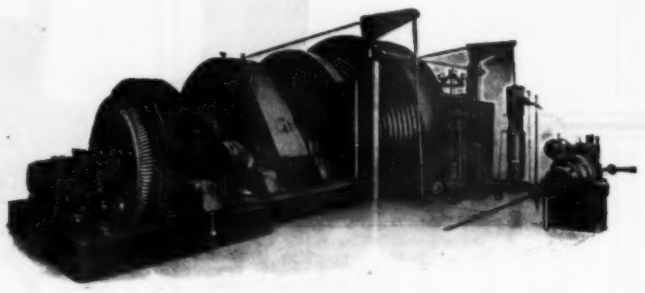
Codes: A B C 5th Edit. Engineering Western Union Marconi Inter.

Winding Engines
and
Air Compressors

The Illustrations show
GEARED ELECTRIC WINDER
made for
Fife Coal Co., Ltd., Leven, Fifeshire.
One Double Cylindro, Conical Drum, 12ft. to 18ft. diameter. Suspended load, including rope, 50,300 lbs. Hoisting Speed, 2034ft. per minute. Length of wind, 1800ft. vertical,
and
VERTICAL CONDENSING STEAM-DRIVEN AIR COMPRESSOR,
made for
The Lewis Merthyr Consolidated Collieries, Ltd.
Capacity, 5000 cubic feet to 80 lbs. per square inch per minute.

Full particulars on application.

Fullerton



HEAD, WRIGHTSON & Co. LIMITED,
ENGINEERS, IRON and STEEL FOUNDERS.

Blast Furnace Charger.

TEESDALE IRONWORKS,

Telegrams: "Teesdale, Stockton-on-Tees."

THORNABY-ON-TEES.

Also STOCKTON FORGE WORKS, and
EGGLESCLIFFE FOUNDRY,
STOCKTON-on-TEES.

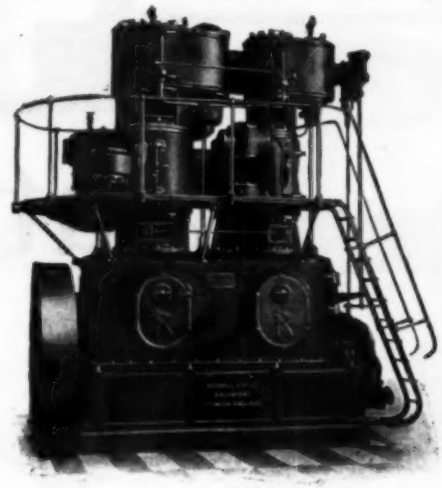
BRIDGES, CYLINDERS AND
STRUCTURAL WORK OF ALL KINDS
RAILWAY CHAIRS,
STEEL CASTINGS
TO
ADMIRALTY INSPECTION.

THE NAME ROYCE CARRIES WEIGHT

ELECTRIC CRANES
DYNAMOS MOTORS
STEEL CONSTRUCTIONAL WORK

ROYCE LTD., Engineers, TRAFFORD PARK, MANCHESTER.

REAVELL
AIR COMPRESSORS
FOR ALL PURPOSES.



We are manufacturers of all types of Air and Gas Compressors and Exhausters. The above illustration is of one of our large Vertical Steam Driven Compressors, while below we show one of our Motor Driven Sets.

These machines are designed for a delivery pressure of 120 lbs. per sq. inch and are manufactured in eleven standard sizes, ranging in capacity from 500 to 5000 cubic feet of free air delivered per minute.

Write to Dept. A. for illustrated leaflets.

REAVELL & CO., LTD.
RANELAGH WORKS,
IPSWICH.

TELEGRAMS:—REAVELL, IPSWICH.
TELEPHONES:—2124 & 2125.

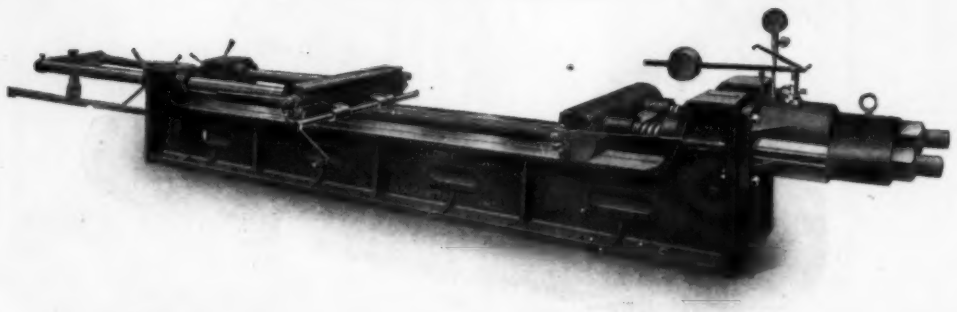
HYDRAULIC MACHINERY

OF ALL KINDS.

Special Machines Designed to Suit Customers' Requirements.

PUMPS,
ACCUMULATORS,
PRESSES FOR
FLANGING,
FORGING,
BENDING,
STAVING,
DRAWING.

FIXED AND
PORTABLE
RIVETTERS.



Hydraulic Plate Straightening Press for plates 12′ 0″ x 4′ 0″ x $\frac{3}{16}$″ thick.

PUNCHES,
SHEARS,
CAPSTANS,
CRANES,
COAL TIPS,
ETC.

CRUDE OIL
ENGINES.

FIELDING & PLATT, LTD.

GLOUCESTER.

Tullis

Leather Belting

Guaranteed 98% Stretchless
Straight Running & Absolutely
Uniform in Quality.

A Tullis Belt for Efficient Power Transmission.

Efficient Labour
and
Modern Machines
cannot offset the
losses caused by
installing Inferior
——Belting.——

John Tullis & Son ltd
LEATHER BELTING SPECIALISTS.
ST. ANN'S WORKS, BRIDGETON, GLASGOW

TELEPHONE: CITY 3421-2.

OERLIKON

TELEGRAMS: OERLIK, ESTRAND, LONDON

SYNCHRONOUS-INDUCTION MOTORS

Combining advantages of ordinary Induction Motors with those of Synchronous Motors:—

High Starting Torque.
Leading Current for P.F. correction.
Simple starting up.
Self-synchronising.

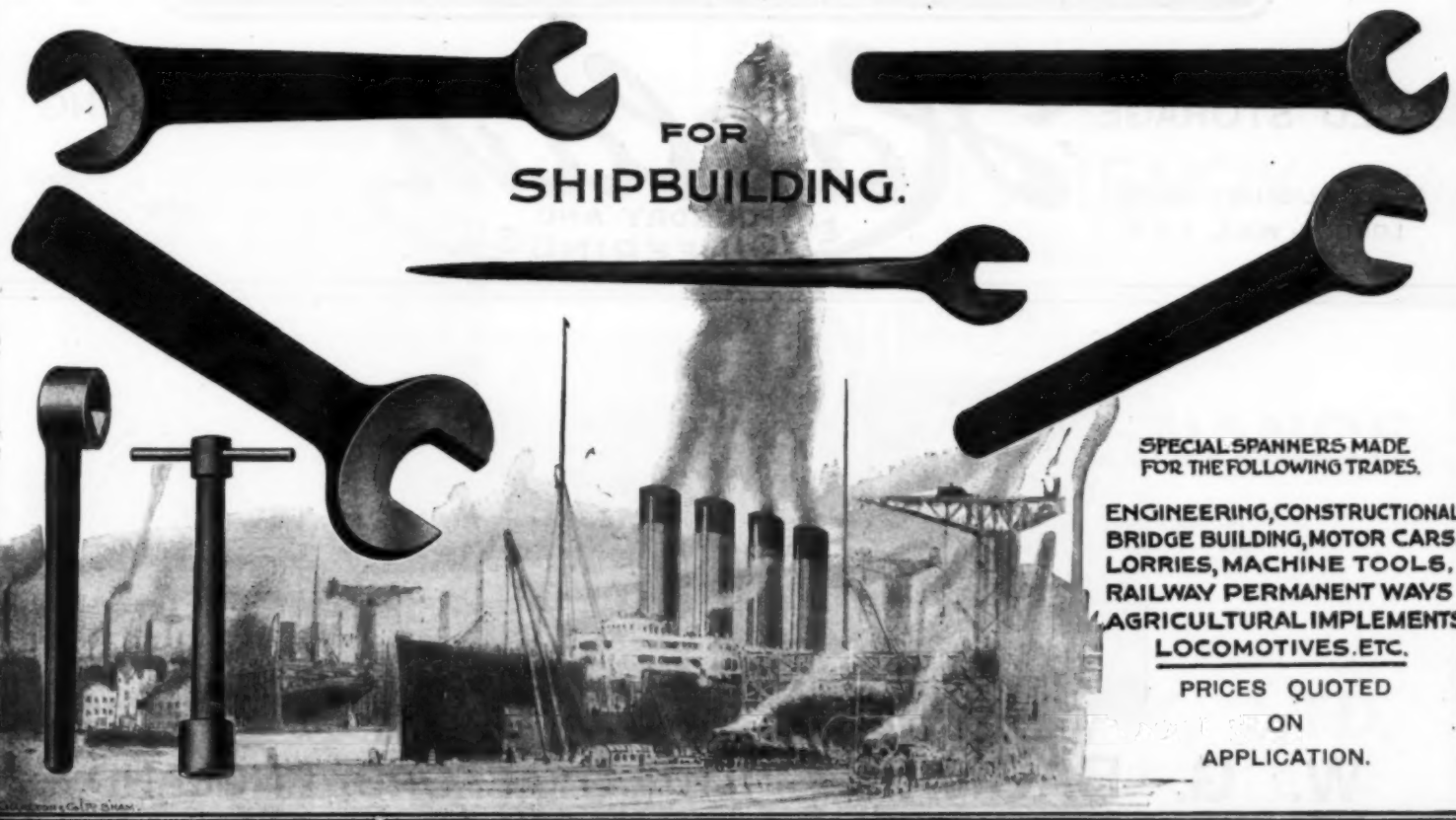
CONSTRUCTED FOR ALL OUTPUTS AND PRESSURES.

Manufacturers of Steam Turbines,
Turbo-Alternators and Electrical Plant of all kinds.

One of four 6,500 B.H.P. Synchronous Induction Motors; P.F. Unity 8,400 volts, 3 phase, 50 cycles, 750 r.p.m., for driving Centrifugal Pumps.

OERLIKON LTD., *ELECTRICAL ENGINEERS AND CONTRACTORS.*
OERLIKON HOUSE, 28-31, ESSEX STREET, STRAND, LONDON, W.C.2.
And Branch at CASTLE BUILDINGS, SWANSEA.

SPANNERS



FOR
SHIPBUILDING.

SPECIAL SPANNERS MADE FOR THE FOLLOWING TRADES.

ENGINEERING, CONSTRUCTIONAL, BRIDGE BUILDING, MOTOR CARS, LORRIES, MACHINE TOOLS, RAILWAY PERMANENT WAYS AGRICULTURAL IMPLEMENTS LOCOMOTIVES. ETC.

PRICES QUOTED ON APPLICATION.

ARMSTRONG, STEVENS & SON — WORKS — WILLENHALL STAFFS ENGLAND

KEARNS For Horizontal Boring Machines

FRANCE. — Societa Anonyme Alfred Herbert, 47, Boulevard de Magenta, Paris.

BELGIUM. —Limbourg Freres, 34, Rue Plantin, Brussels.

ITALY. — Societa Anonima Italiana Alfred Herbert, 42, Via Cajazzo, Milan.

JAPAN.—Alfred Herbert, Ltd., 28, Higashi Umeda - cho, Kitaku, Osaka, Japan.

INDIA.—Alfred Herbert, Ltd., 13, British India Street, Calcutta.

AUSTRALIA. — Mr. G. E. Young, 66, Clarence Street, Sydney.

"KEARNS PATENT"

Combining Automatic Facing with Traversing Spindle.
Made in 5 sizes, with or without Traversing Spindle.
Our Machines are absolutely universal. Consult us before purchasing other Machine Tools.
WRITE FOR CATALOGUE. TEST PIECE WITH EVERY MACHINE.
Positive proof of Accuracy

H.W. KEARNS & CO. LTD. BROADHEATH NEAR MANCHESTER.

CO_2 **REFRIGERATION** NH_3

COLD STORAGE

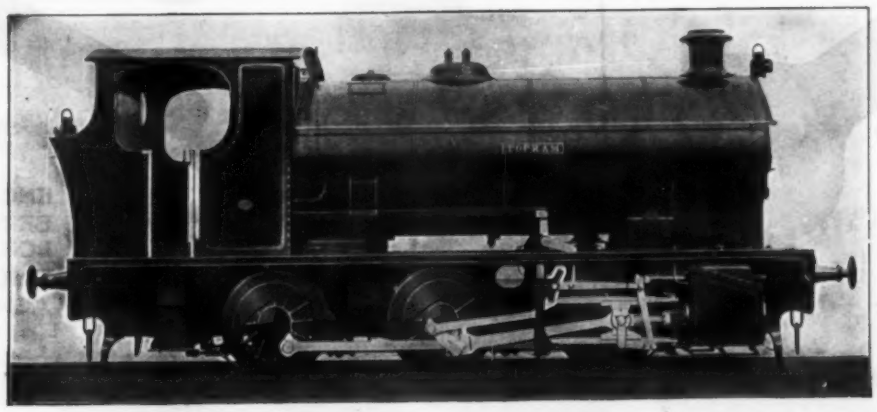
541-3, SALISBURY HOUSE, LONDON WALL, E.C.2.

Haslam FOUNDRY AND ENGINEERING CO. LTD.

ICE - MAKING

HEAD OFFICE & WORKS: DERBY.

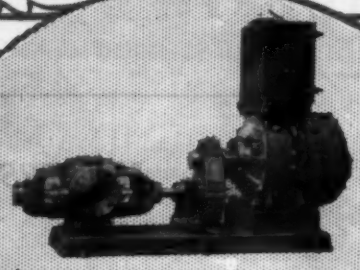
Telegrams: "ZERO, DERBY."



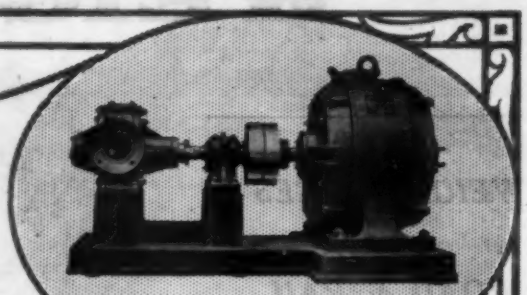
W. G. BAGNALL, LTD., STAFFORD, ENGLAND,

Code used: "A.B.C." Telegrams: "Bagnall, Stafford." LONDON OFFICE: 32, Victoria Street. Telephone No.: 1892 Victoria.

BUILDERS OF LOCOMOTIVES WEIGHING FROM 3 TO 50 TONS, FOR ANY GAUGE, OF HIGHEST CLASS WORKMANSHIP & MATERIAL
TIPPING TRUCKS, SUGAR CANE WAGONS, TURNTABLES, SWITCHES, &c.



FUEL OIL & BALLAST PUMP.

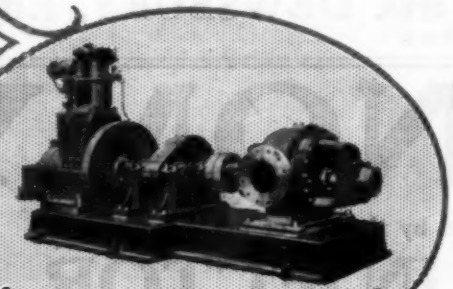


FORCED LUBRICATION PUMP.

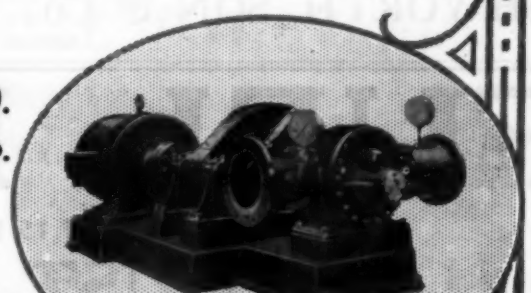
LAND AND MARINE PUMPS

The simple and valveless construction of our Rotary Pump gives it high rank amongst pumps of positive action for high and low viscosity fluids.

Our designs are the result of considerable experience in handling liquids including Fuel and Lubricating Oils, Tar and Bitumen Mixtures, Molasses, Glucose, Cable Compound, Caustic Liquor, Soap, Liquid Polish, Spirits, etc.



STEAM JACKETTED BITUMEN PUMP.

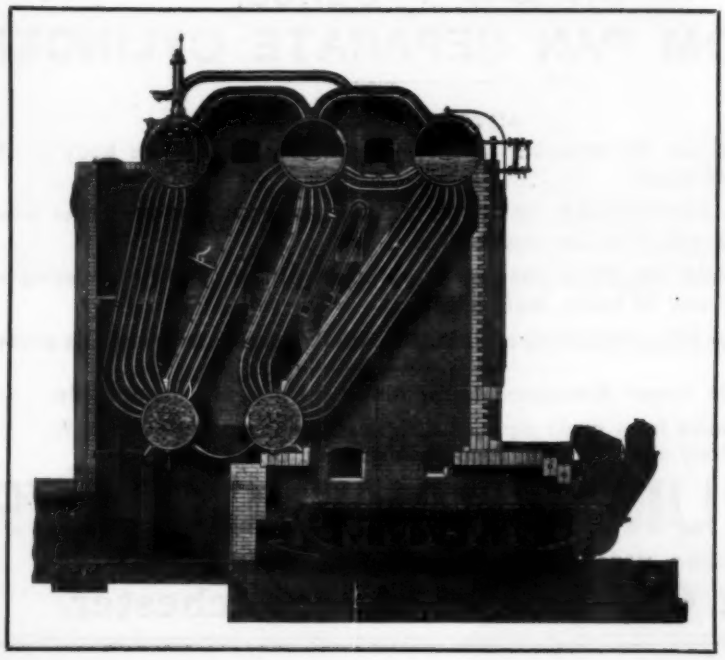


MOLASSES TRANSFER PUMP.

STOTHERT & PITT, LTD.

BATH - - ENGLAND.

STIRLING BOILERS



FOR

MAXIMUM EFFICIENCY

AND

MINIMUM MAINTENANCE COSTS.

THE STIRLING BOILER COMPANY, LTD.

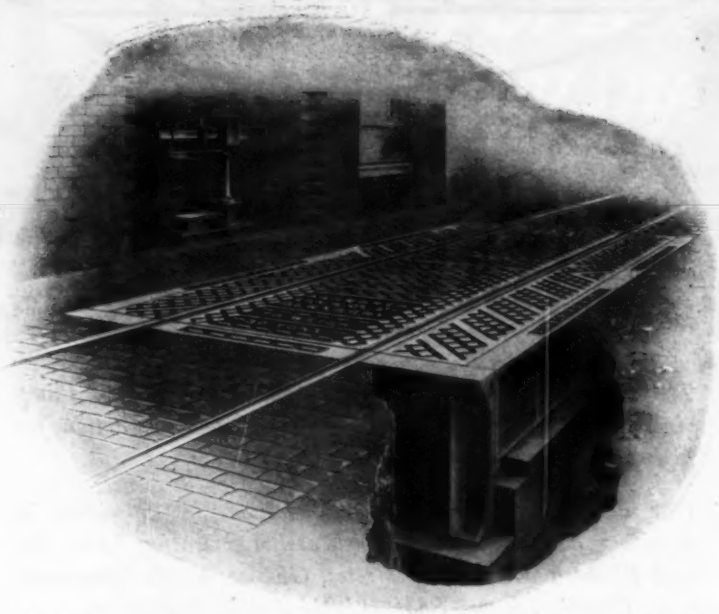
32-38, FARRINGDON STREET - - - LONDON, E.C. 4.

Telephone: CITY 5378 and 5379. Telegrams: "STIRLINICO, CENT, LONDON."

WEIGHBRIDGES.

WEIGHBRIDGES
FOR
ROAD & RAIL
TRAFFIC.

ANY LENGTH
& CAPACITY.



MAKERS
OF
ALL TYPES
OF
WEIGHING
APPARATUS.

ASHWORTH, SON & Co., Ltd., Midland Iron Works, DEWSBURY, England.
London Office: 78, FINSBURY PAVEMENT, E.C.2.

FUEL ECONOMY.

A Reduction of 15 PER CENT. in Fuel is obtained by the use of the

EXHAUST STEAM INJECTOR

(METCALFE'S PATENT TYPE "F") FOR BOILER FEEDING.

DAVIES & METCALFE, LTD.,

ROMILEY, near MANCHESTER.

Telegrams—"EXHAUST." ROMILEY. Telephone—2219 STOCKPORT. Railway Address—ROMILEY, G.C. & M. Ely.

Telegrams—
Solution, Parl, London.

Telephone—
Victoria 3269.

THE
VACUUM BRAKE CO., LTD.,
PATENT F CLASS,
BOTTOM PAN SEPARATE CYLINDER

ADVANTAGES.

1. The PISTON can be removed from cylinder without taking the body of the cylinder down.
2. The Patent REVERSIBLE RELEASE VALVE, the train pipe branch of which can be placed at any desired radial position.
3. The RELEASE VALVE is attached to the upper half of the cylinder casing out of the way of brake shaft lever.
4. A GUIDE for ROLLING RING ensuring the latter returning to the resting groove.

Variable Brake Power Arrangements for Maximum and Minimum Loads.

Why incur the risks of accidents from burst pipes, &c., inherent with pressure brakes?
These are entirely absent in our Vacuum Automatic Brake.

THE VACUUM BRAKE CO., LTD.
3, 5, and 7, Old Queen Street, Westminster, LONDON, S.W. 1.
GRESHAM & CRAVEN, Ltd., Manchester.

THE
PATENT

LIGHTNING CRUSHER

Unequalled for reducing Hard Materials such as Shingle, Gravel, Flint, Silica, Magnesite, Limestone, Freestone for Building Sand, etc.

'Grams "Agenciador, London." THE PATENT LIGHTNING CRUSHER Co., Ltd., 14a, Rosebery Avenue, London, E.C. 'Phone: Clerkenwell 669.

GLENGARNOCK IRON & STEEL WORKS GLENGARNOCK

DAVID COLVILLE & SONS LTD

DALZELL STEEL & IRON WORKS MOTHERWELL

CLYDEBRIDGE STEEL WORKS CAMBUSLANG

REGD. OFFICE
195, W. GFORGE ST.
GLASGOW.
TELEPHONE-
CENTRAL 9277/94
TELEGRAMS-
"COLVILLETT, GLASGOW

PLATES
BOILER.
HIGH TENSILE BOILER.
SHIP.
ELASTIC LIMIT.
LOCOMOTIVE.
BRIDGE. . . . TANK.
SPECIAL HIGH TENSILE.
WEATHER RESISTING.
NICKEL & OTHER ALLOY

SECTIONS
ANGLES. BULB ANGLES.
CHANNELS & TEES.
JOISTS.
SPECIAL SECTIONS.
ROUNDS. . . SQUARES.
FLATS. . . HEXAGONS
SLABS & BILLETS.
WIRE & TUBE BILLETS.
FORGING INGOTS,
AND BLOOMS.

RAILS
MAIN LINE.
BULL HEAD.
FLAT BOTTOM.
BRIDGE. . TRAMPLATE.
CRANE. . . . . .
FISHPLATES
(Shallow and Angle).
SLEEPERS AND
ACCESSORIES.

PIG-IRON
"DALZELL"
SCOTCH
FOUNDRY,
AND
SPECIAL
REFINED.
MADE AT
GLENGARNOCK WORKS.

LONDON OFFICE
6, SPRING GARDENS
COCKSPUR STREET
S.W.1.
TELEPHONE
GERRARD 1566
TELEGRAMS
COLVILLE WESTRAND
LONDON.

G. P. BANBURY EAST SURREY IRONWORKS CROYDON

Telephone: CROYDON 1570. **Established 1901.** *Telegrams: IRON, CROYDO .*

STRUCTURAL AND MECHANICAL ENGINEERS.

WE QUOTE FOR AND SUPPLY

BUILDINGS AND PLANT COMPLETE.

Also Component Parts Cast, Forged or Machined for Breakdowns or Other Special Need.

STRUCTURAL WORK FROM SECTIONS OR PLATES; PATTERNS, AND PERFECT CASTINGS UP TO 7½ TONS.

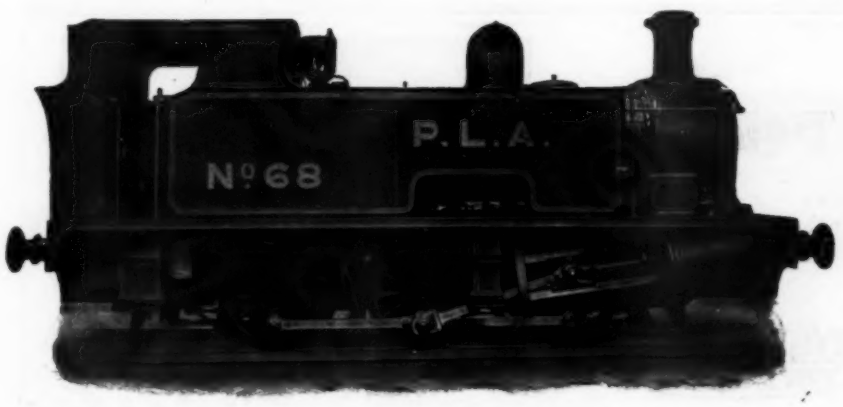
ALL MACHINED AND ASSEMBLED THROUGHOUT IN THESE WORKS.

WORKS AND DRAWING OFFICES 9 MILES FROM WESTMINSTER. *EXPORT ORDERS F.O.B. LONDON OR SOUTHAMPTON.*

ESTABLISHED 1860.

HUDSWELL, CLARKE & CO., LIMITED.

RAILWAY FOUNDRY, LEEDS.



LOCOMOTIVE ENGINES

FOR MAIN OR BRANCH RAILWAYS,

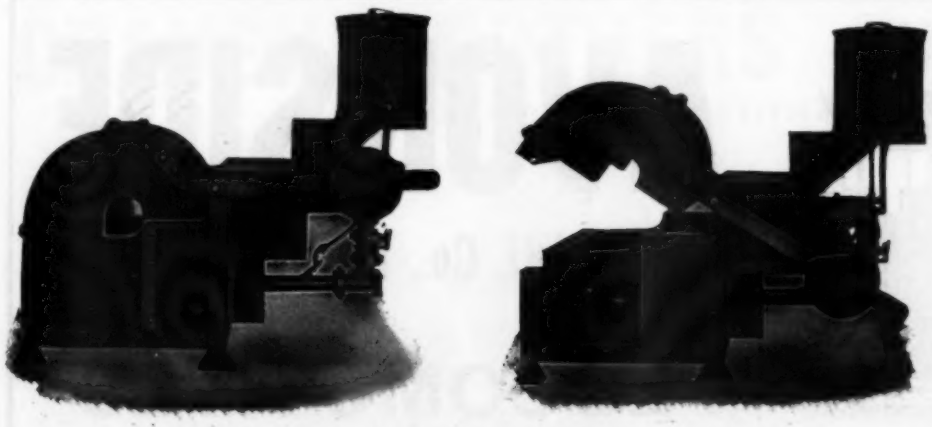
Docks, Contractors, Steelworks, Collieries, &c.
All Sizes and to suit any Gauge of Railway.

Also Makers of

Internal Combustion Rail Locomotives.

Prices, Photographs and full specifications on application.

Telegrams—Loco, Leeds. Telephone—National 20993.
Codes—A1, Lieber's, A B C (4th and 5th Editions).



PIPE BENDING HEARTHS

Balanced Cover Closed. Balanced Cover Raised.
Supplied in sizes to suit any diameter of pipe.

OIL GAS.

The Howden Burdon Patent Systems For Steelworks, Shipyards, Factories, &c.

Furnaces of any size and for all heating requirements.

Highest Temperatures. Lowest initial and working costs.

Cheaper, softer and quicker heating than is possible by coal in any form.

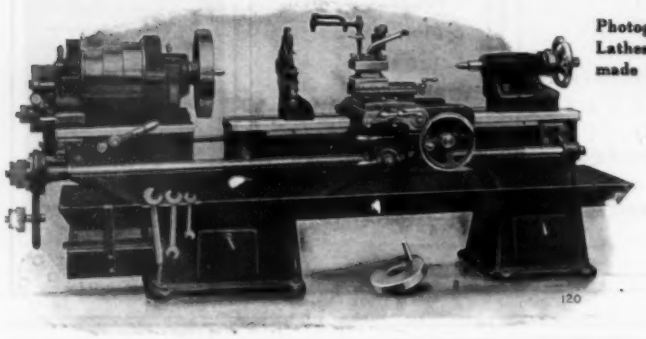
Smokeless—No Chimney Stack.

Enquiries may also be sent to JAMES HOWDEN & Co., Ltd., Scotland St., GLASGOW.

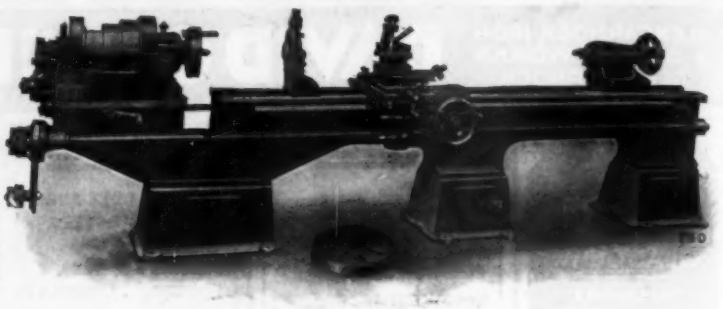
BURDONS (K) LIMITED, 195, Scotland Street, GLASGOW.

HIGH SPEED GAP BED LATHES

With all the latest improvements



Photographs of 8½in. Lathes, which can be made with any length of Bed



Kindly ask us for price and particulars.

Willson

(SMITH BARKER AND WILLSON)
Machine Tool Makers,
EAST MOORSIDE, HALIFAX, ENGLAND.

Telegrams: LATHE, HALIFAX. Telephone: Halifax 46.
Western Union, 5 letter. ABC, 5th & 6th Ed. Marconi International.

HILL & SMITH, LTD.

Constructional Engineers,
BRIERLEY HILL, STAFFS.

Steel Framed Buildings
Roof Principals Bridges
Girders .. Gantries
Runways .. Hoppers

STRUCTURAL STEELWORK
of every description.

CLYDE CRANES

CLYDE CRANE & ENGINEERING CO., LTD., MOSSEND, near GLASGOW.

FOR
STEELWORKS, HARBOURS, SHIPYARDS AND DOCKS, LEVEL LUFFING CRANES.
(JARDINE PATENTS).

DRYSDALE CENTRIFUGAL PUMPS

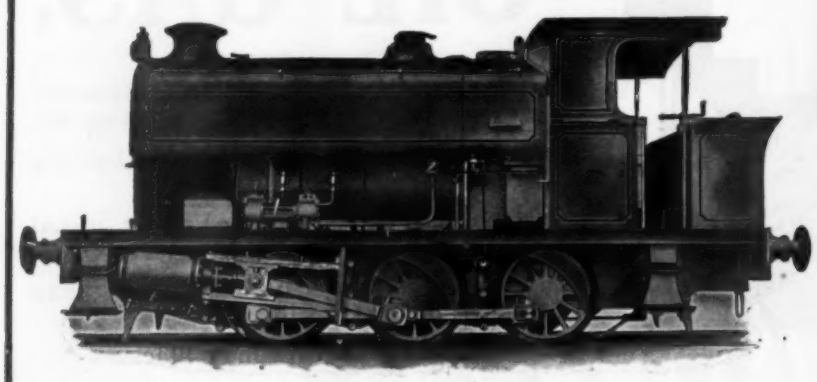
The illustration shows a typical Electrically-driven Dock Pumping Installation of the Horizontal Type.

Where installation conditions demand, Pumps can be arranged of the Vertical Spindle type.

REGISTERED TRADE MARK
DRYSDALE
REG NO 457390.

MONOMARK-BCM/4RY.

DRYSDALE & Co. Ltd. YOKER : GLASGOW



AVONSIDE

ENGINE Co., LTD., BRISTOL.

LOCOMOTIVES

IN STOCK AND PROGRESS.

2–8–0 Type Locomotive Tender, 5' 6" gauge

Sole Licensees for

THE GARRATT PATENT ARTICULATED LOCOMOTIVE

and

The LJUNGSTROM PATENT TURBINE LOCOMOTIVE

(In the British Empire).

Mechanical parts of Electric Locomotives for the English Electric Co., Ltd.

STEAM, ELECTRIC & DIESEL LOCOMOTIVES OF ALL TYPES

Garratt Patent Articulated Locomotive

GRINDING MACHINES

PORTABLE MACHINES

For Railway Shops and other purposes.

STEEL CASTINGS

Loco. Wheel Centres a Speciality.

Ljungstrom Turbine Condenser Locomotive

BEYER, PEACOCK & CO., LTD. Gorton Foundry, MANCHESTER.

VONO SEMI-STEEL VICES

"AS GOOD AS THEY LOOK."

THE VONO COY.

Duport Foundry, DUDLEY PORT, STAFFS.

LONDON OFFICE: 21-24, COCKSPUR ST., PALL MALL, S.W.1.

THE ISCA FOUNDRY CO. NEWPORT, LTD., MON.

LONDON OFFICE: 82, VICTORIA STREET, S.W.1.

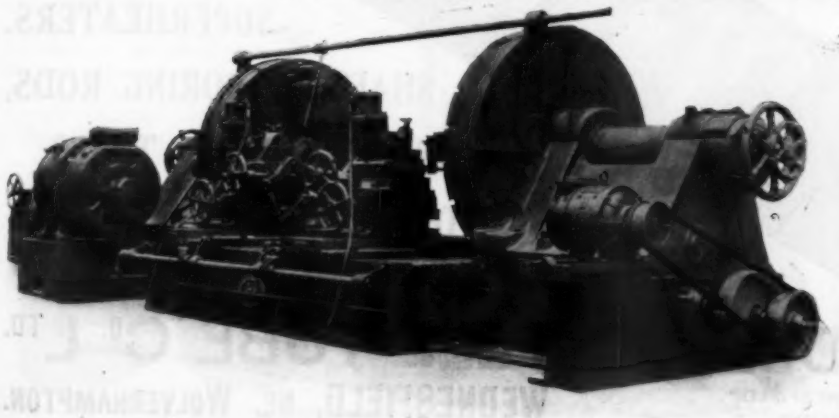
Telegraphic Address: ISCA, VIC., LONDON; ISCA, NEWPO.

FOR RAILWAY SWITCHES AND CROSSINGS CHAIRS

TANKS, WATER CRANES, BUFFER STOPS, TURNTABLES BRIDGES, ROOFS, SIGNALS, HYDRAULIC FLANGE & SOCKET PIPES, CASTINGS &c

CRAVEN BROTHERS (MANCHESTER) LIMITED,

VAUXHALL WORKS, REDDISH, STOCKPORT, ENGLAND.



ELECTRICALLY DRIVEN

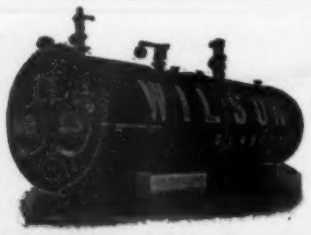
HEAVY TYPE LOCO. AND TENDER WHEEL LATHE

6ft. DIA. FACEPLATES.

FITTED WITH

Patent Pneumatic Tool Clamp.

OUTPUT: We are prepared to give guaranteed output.



WILSON BOILERMAKERS LTD.
Lillybank Works, GLASGOW.

ORR & WATT & Co., LTD STEEL STRUCTURAL ENGINEERS
LANARKSHIRE BRIDGE WORKS
MOTHERWELL, SCOTLAND.
ROOF & BRIDGE BUILDERS.
HYDRAULIC PRESSED STEEL TROUGH FLOORING FOR ROAD & RAILWAY BRIDGES, BUILDINGS, ETC.

MECHANS LIMITED,
Engineers & Contractors,
SCOTSTOUN IRONWORKS, GLASGOW.
LONDON OFFICE:
10, Princes Street, Westminster, S.W.1.
See Illustrated Advertisement appearing every fourth week.

JOHN ROGERSON & CO., LTD.,
WOLSINGHAM, R.S.O., Co. DURHAM.
Makers of
Steel Castings and Steel Forgings,
Stockless Anchors, Dredger Buckets, Links and Tumblers, Steering Gear, &c. &c.
SEND YOUR ENQUIRIES.
Telegrams: Steelworks, Wolsingham.

ALFRED DANKS, LTD.
MARINE AND GENERAL ENGINEERS,
WROUGHT IRON PULLEY MAKERS.
GREY IRON AND MALLEABLE IRON CASTINGS OF EVERY DESCRIPTION.
Telephone 3041 Telegrams, "Pulleys," Gloucester.
EMLYN WORKS, GLOUCESTER.

THE
MACFARLANE ENGINEERING CO
LTD.,
NETHERLEE ROAD, CATHCART.
DYNAMOS & MOTORS.

WHITECROSS ARMCO
Ingot Iron Electrodes
99·84% Pure
THE WHITECROSS COMPANY LIMITED
WARRINGTON

BROTHERHOOD
REFRIGERATING PLANT.
PETER BROTHERHOOD, LTD.,
PETERBOROUGH.
See our large advertisement June 3rd.

SUPERHEATERS FOR ALL TYPES OF BOILERS.
T. SUGDEN, LTD.,
150, Fleet Street, London, E.C. 4.
See Advt.—"Engineer"—June 3.

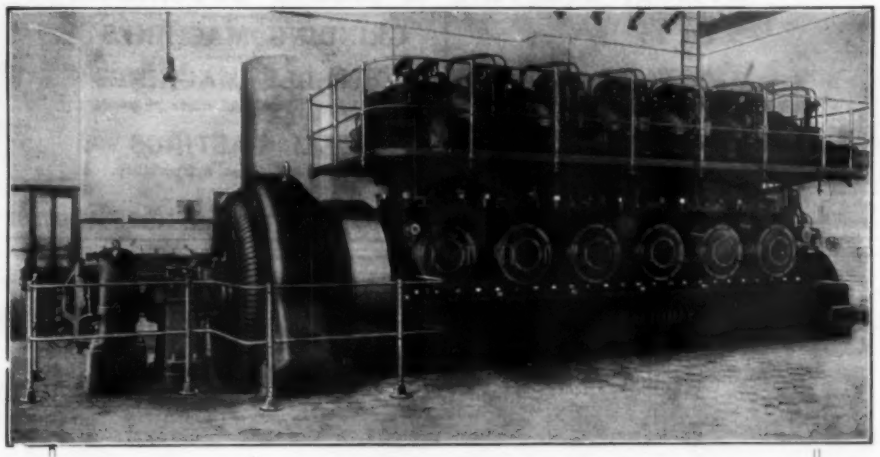
WOOTTON BROS., LTD.,
COALVILLE, near LEICESTER.
Telegrams: Wootton, Coalville.
Brickworks Plant. Sanitary Pipe Plant.
CLAY-WORKING PLANT.
Colliery Plant. General Millwrights

HAMWORTHY
OIL ENGINES.
PUMPS & AIR COMPRESSORS.
THE HAMWORTHY ENGINEERING CO., Ltd., Poole, Dorset.
Branches { 76, Victoria Street, LONDON. 103, West Regent Street, GLASGOW.

PEGLER BROS. (GLASGOW) LTD.,
BRIDGETON SMELTING WORKS,
Fordneuk Street, BRIDGETON.
Regd. Office: 54, Brown Street, GLASGOW

BOILERS — ENGINES
HIGH CLASS LANCASHIRE & LOCOMOTIVE BOILERS, ETC. — STEAM & ELECTRIC WINDING ENGINES 'INGLIS' PATENT CONTROLLER.
Coupling Cylrs. — CRANE WINCHES.
BOILER REPAIRS. — ENGINE REPAIRS.
ELECTRIC HAULAGES THREE THROW PUMPS. — COAL SCREENING & WASHING PLANT.
G. INGLIS & CO. LTD. ALBERT ENGINEERING & BOILER WORKS, KIRKDIE

NATIONAL GAS ENGINES



600 B.HP. National Vertical Gas Engine driving Electrical Generator at Thorncliffe Coal Distillation Ltd., Thorncliffe Collieries, Nr. Sheffield.

SPECIAL FEATURES of National Vertical Gas Engines.

No moving parts water-cooled.
No heavy weights.
No complicated valve gear.
Easily accessible for cleaning purposes.
Easy to start up.
Standardization.
Small floor space occupied.
Utmost reliability.
Highest economy.
Interchangeability of parts.
Forced lubrication.

National Vertical Gas Engines totalling 100,000 B.HP., are at work in all parts of the world. They are designed for operation on town, producer, blast furnace and coke oven gases, and due to the excellent turning effort and good governing obtainable, they are particularly suitable for driving both alternating and direct current electrical generators.

Engines of the single cylinder, per crank type, are manufactured in sizes from 90 to 900 B.HP., and engines of the tandem type from 300 to 2500 B.HP.

WE ALSO MANUFACTURE EXTENSIVELY HORIZONTAL AND VERTICAL HEAVY OIL ENGINES IN STANDARD SIZES FROM 18 TO 600 B.H.P.

If you are in the market for power, please write us for catalogue and quotation.

THE NATIONAL GAS ENGINE CO., LTD., ASHTON-UNDER-LYNE.

BUY FROM THE ORIGINAL MAKERS
. . OF . .
WELDLESS STEEL TUBES
. . FOR . .
WATER TUBE BOILERS,
LOCOMOTIVE BOILERS
MOTOR AXLES.

W TRADE MARK.

SUPERHEATERS.
SHAFTING, BORING RODS,
STAINLESS STEEL TUBES
FOR ALL PURPOSES.

WELDLESS TRADE MARK.

THE WELDLESS STEEL TUBE Co. LTD.
Telegrams:—"WELDLESS, WEDNESFIELD."
Telephone:—1301-1302 Wolverhampton.
WEDNESFIELD, NR. WOLVERHAMPTON.

Beldam's "V" Pilot Packing

FOR STEAM OR WATER.

Sole Patentees and Manufacturers:—

THE BELDAM PACKING & RUBBER CO., LTD.

16, GRACECHURCH STREET : LONDON, E.C. 3.

Telephone: AVENUE 4774 (3 lines). Telegrams & Cables: "VEEPILOT."

Works: BRENTFORD, LONDON, PARIS & NEW YORK. ESTD. 1876. (9A)

Cutting The Cost Of Delays

4-Yard Full Revolving Electric Shovel

Electric shovels have many advantages in installations where the machine is not required to move about to any great extent.

The Bucyrus 120-B Electric Shovel provides a New and Cheaper Method for digging Greater Tonnages per day in Mine and Quarry.

In mine and quarry, conditions are such that the fullest advantages of the electric shovel are enjoyed by the owner. The Bucyrus electric shovel cuts the costs of delays to the very minimum—the pull of a switch stops all consumption of power. There is no fire to be banked for the night, no night watchman is needed on the shovel. The operation of the machine is smooth and vibrationless—the untired operator will produce greater yardages per day. And Bucyrus Electric machines have the additional advantages of the highly perfected, smooth and positive Ward-Leonard Control.

BUCYRUS BUILDS:
Revolving shovels and draglines of all sizes—steam, electric, Diesel, Diesel-electric and petrol engine powered; railroad type shovels; levee building machines, dipper, hydraulic, elevator and placer dredges, railway cranes, spreader plows and ballast plows.

In addition to these advantages of electric power the Bucyrus 120-B shovel (which may be supplied with either steam or electric drive) combines great power and dipper capacity with very rugged construction and **quick motions.**

With base and revolving frame of huge steel castings, this machine should not be confused with any European shovels which have these units built up out of structural steel and which lack the speed of action and the smoothness of operation of this new Bucyrus 4-yard full revolving shovel.

Your inquiries are invited.

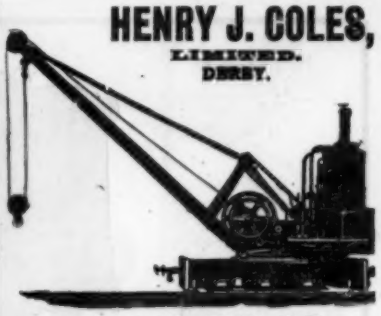
BUCYRUS COMPANY,

Head Office: South Milwaukee, Wis., U.S.A. London Office: Windsor House, 83, Kingsway, W.C.2.

BUCYRUS

Established in 1880. Registered Trade Mark. 180

HENRY J. COLES,
LIMITED.
DERBY.



MAKERS OF STEAM AND ELECTRIC TRAVELLING CRANES, SINGLE AND DOUBLE CHAIN GRABS STEAM CRANES, NAVVIES, PETROL and OIL MOTOR DRIVEN CRANES, SHUNTING & BREAKDOWN CRANES.
Telegrams:—COLES, DERBY. Telephone —1256 DERBY

Werf GUSTO, Firma A. F. Smulders,
SCHIEDAM, HOLLAND.
SPECIALITIES—
DREDGING PLANT, FLOATING CRANES AND COALING VESSELS.
See our page Advt. in further issues.

A. BEEBEE,
Bolts, Nuts, Studs, &c.
WEDNESBURY.

BELLISS & MORCOM
BIRMINGHAM. LTD.
Self-lubricating Steam Engines, Steam Turbines, Air & Gas Compressors (Reciprocating & Rotary), Condensing Plants, High Efficiency Oil Engines, Paraffin Engines, Pneumatic Hose Couplings.
See illustrated Advt. every month.

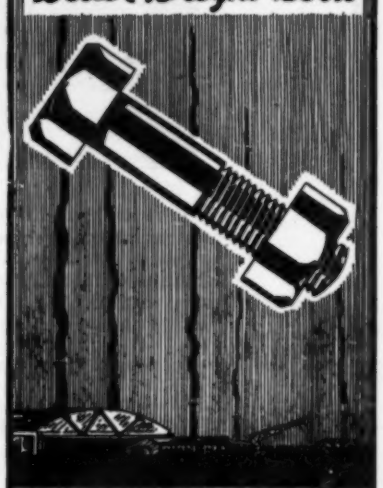
Ritchie-Atlas CONVEYING MACHINERY
RITCHIE-ATLAS ENGINEERING CO.
ATLAS WORKS • TEMPLE • GLASGOW.

GOODALL CLAYTON & Co LTD
LEEDS
CONVEYING PLANTS, BUNKERS &c

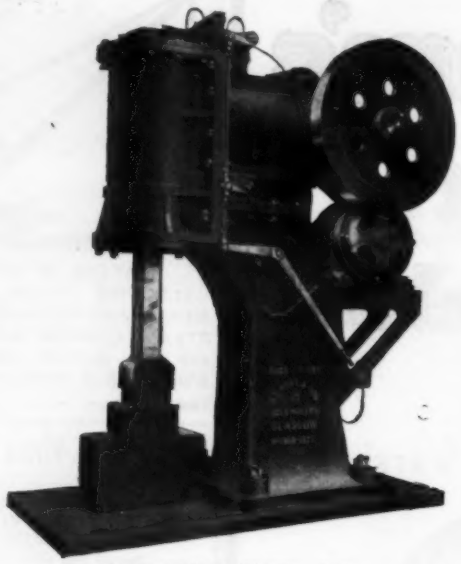
The CLYDE STRUCTURAL IRON Co., Ld.
Clydeside Ironworks, Scotstoun, Glasgow.
STEEL ROOFS
London Agents:—GILLESPIE & CO., Ltd., Londonhall Bldgs., 1, Londonhall St., London, E.C. 3.

HULL FORGE IRON & STEEL CO., Ltd.
Manufacturers of
BAR IRON & STEEL
in all sections and qualities.
EAST RIDING IRON WORKS, HULL.
London Office: 31, Victoria Street, S.W.

Better Bright Bolts



A. P. NEWALL AND Co. Ltd.
POSSILPARK, GLASGOW.



Representing 10 cwt. size.

The Motor-driven Hammers
that do forging work **in**
Steam Hammer time and better.

Don't forget their name: **ROSS-RIGBY**

Made ONLY by:

R. G. Ross & Son Ltd.

Greenhead - - - Glasgow

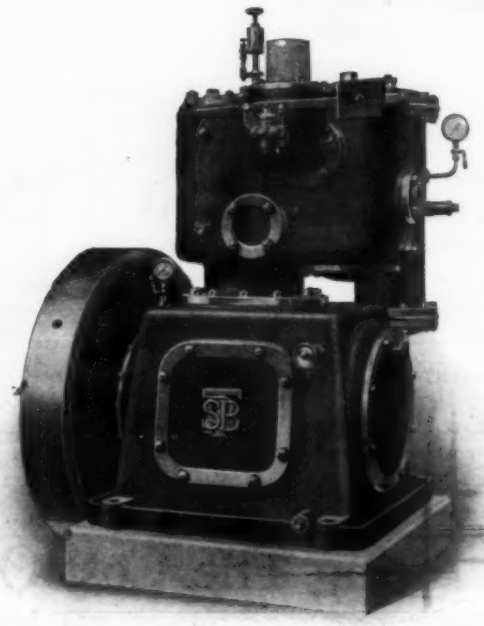
Pioneers and Specialists in Forging Plant.

ECONOMY AND EFFICIENCY

are easily attained in any Compressed Air Installation when

TILGHMAN AIR COMPRESSORS

ARE INSTALLED



SILENT IN OPERATION

Built in all capacities up to 2500 cubic ft.

Established 1874.

Ask for Catalogue.

TILGHMAN'S PATENT SAND BLAST CO. LTD.

BROADHEATH - - Nr. MANCHESTER.

BLISS **A One Operation Job** BLISS

on a

BLISS PRESS

If it is a Press job consult us. We build presses for every stamping proposition. Here is one of our Trimming Presses trimming a six-throw automobile crankshaft in one operation after forging. Write for details of our Drop-Forging Plant to-day. It will interest you.

E. W. BLISS CO.

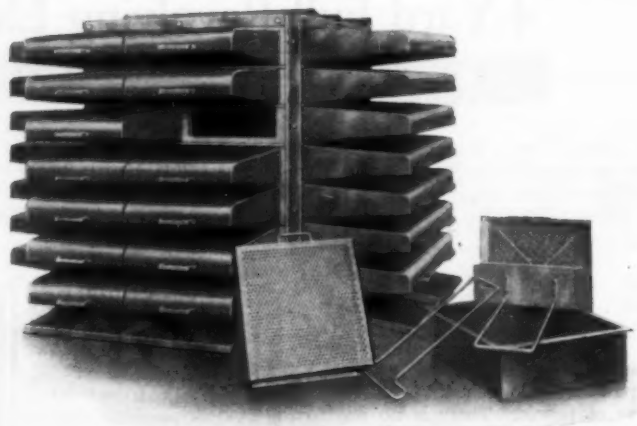
21, POCOCK STREET, LONDON, S.E. 1.

Telephone: Hop 4340. *Telegrams: "Blissdon London."*

BIRMINGHAM SHOWROOM AND OFFICES:
Norwich Union Chambers, Birmingham.

WELLMAN BIBBY AIR FILTERS

Efficient . . . Economical



WELLMAN BIBBY AIR FILTER—QUADRANGLE TYPE.

These Filters effectively arrest all solid particles in the air, allowing clean air only to escape—are easy to maintain—occupy very little space, and have no mechanism.

BOOKLET ON REQUEST.

THE WELLMAN BIBBY CO., LTD.

VICTORIA STATION HOUSE, LONDON, S.W.1.

Telephones:
VICTORIA 7752-3-4.

Telegrams:
COUPLINGS, SOWEST, LONDON.

Telegrams—
"BRAKE," Manchester.
"EXCLUDING," Parl. London.
Telephone—
No. 813 CENTRAL, Manchester.
Nos. 9770—9771 VICTORIA, London.
CABLE ADDRESS: "BRAKE," MANCHESTER. CODES: A.B.C. 5th & 6th.

GRESHAM'S PATENT

INJECTORS

Hot Water Injectors for dealing with water up to 140 deg. with 180 lb. pressure.

Largest and Oldest Makers of Injectors in the Kingdom.
Every Class of Injector Made.

GRESHAM & CRAVEN LTD.,

HEAD OFFICE AND WORKS:
ORDSALL LANE, SALFORD, MANCHESTER.

London Office:
40, WOOD STREET, WESTMINSTER, S.W.1.

GLASGOW OFFICE: WM. LESTER & SONS, 11, WEST REGENT STREET.
NEWCASTLE-ON-TYNE OFFICE: FRED CRIPWELL, 18, BIGG MARKET.
BELFAST OFFICE: R. PATTERSON & SONS, 13 & 15, BRIDGE STREET

OVERSEAS AGENTS:

FRANCE, BELGIUM, SPAIN AND PORTUGAL:
Walter Strapp, 15, Rue de Madrid, Paris.
HOLLAND: Th. H. M. De Grijs, 17, Wenckenbachstraat, The Hague.
ITALY: Giovanni Cheschetti, Piazza Sicilia, 1, Milan.
AUSTRALIA: Adams & Co., 521-523, Collins Street, Melbourne.
INDIA: Heatly & Gresham, Ltd., 204, Hornby Road, Bombay. Madras: 14 & 15, Popham's Broadway
Do. 6, Waterloo Street, Calcutta. Lahore: 31, The Mall.
SOUTH AMERICA: Evans, Thornton & Co., 425, Calle Defensa, Buenos Ayres.
POLAND, ROUMANIA AND THE NEW STATES:
British Engineers & Traders Syndicate, Ltd., Australia House, Strand, London, W.C.
SOUTH AFRICA: Jenkins & Co., 12-14, Greenmarket Square, Cape Town.
Do. Mercury Lane, Durban.
Do. Ginsberg Chambers, Johannesburg.

52 Lancashire Boilers have been supplied by us for one customer, who has installed them in England, France and Canada. They know they are good boilers.

Year after year they continue to mature into a better and better product.

To-day it is impossible to buy a better boiler at any price.

Phone: 96 & 19 PRESTON. 'Grams: FOSTER, PRESTON.

JOSEPH FOSTER AND SONS.
SOHO FOUNDRY. PRESTON

HENSCHEL LOCOMOTIVES

of all gauges and sizes,
for main and secondary lines,
contractors' engines, etc.

Annual Capacity: 1,000 Locomotives.
Total Output: Over 20,500 Locomotives.

Steam road rollers and other road-building machinery,
Portable and semi-portable engines,
Box and trough tipping wagons,
Motor trucks and 'busses.

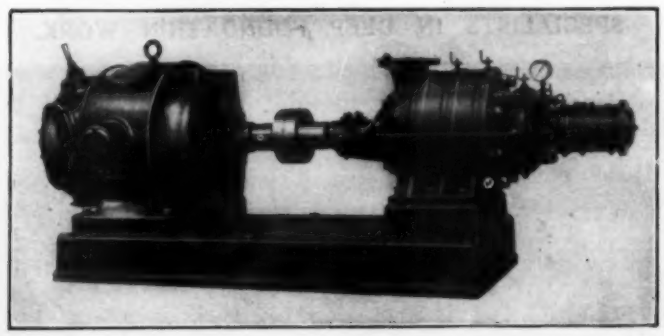
London Agents:—Messrs. GOSSELL & SON, LTD.,
110, Cannon Street, — LONDON, E.C.4.
Telephone No.:—City 6754. Telegraphic Address:—"GOSSOTTO," London.

CENTRIFUGAL PUMPS

FOR EVERY POSSIBLE SERVICE.

LOW, MEDIUM AND HIGH LIFT.

Built for Efficiency and Durability.



ELECTRICALLY DRIVEN THREE STAGE HIGH LIFT TURBINE PUMP.

Special PUMPS for MUD, SAND, GRAVEL, &c.

Write for Catalogues to:

F. A. PULLEN & CO
ENGINEERS

EMPIRE WORKS, VAUXHALL, LONDON, S.E. 11.

Telegrams:
PULLEN, 'Phone-London.
Telephone:
Brixton, 571/2.

SMITH'S Screw Boss Pulley

WITH INTERCHANGEABLE SCREW BUSH

IS THE FINEST PULLEY PROPOSITION ON THE MARKET

Send for Illustrated Booklet. *The Prices will surprise you*

TELEPHONE 19 Thrapston

SMITH & GRACE, LTD.,
Engineers and Ironfounders,
THRAPSTON, NORTHANTS.

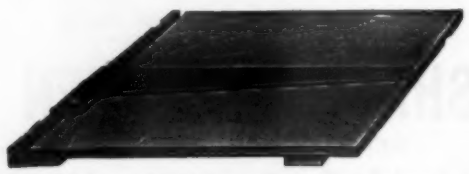
TELEGRAMS "Grace, Thrapston."

LONDON: 35, Queen Victoria Street, E.C. 4. *Phone 9681 City.*

TRADE **STANLEY** MARK

THE LARGEST MANUFACTURERS OF SURVEYING AND DRAWING INSTRUMENTS IN THE WORLD.

FOREMOST AMONG THE BEST



STANLEY-HOWARD DRAWING BOARD AND TEE SQUARE.

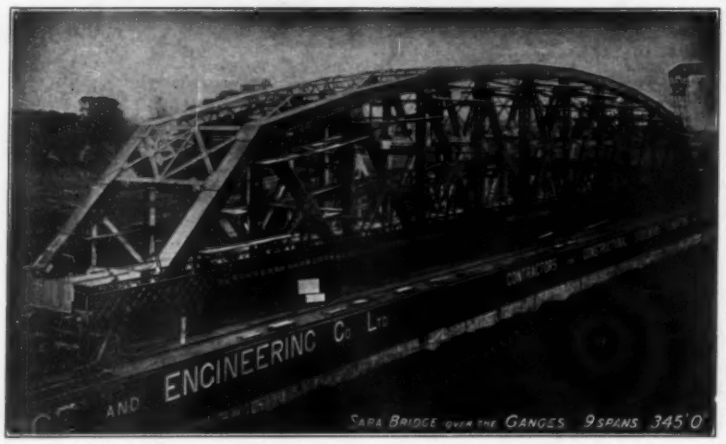
LATEST "M29" CATALOGUE SENT POST FREE ON APPLICATION.

W. F. STANLEY & CO., LTD.
286, HIGH HOLBORN, LONDON, W.C. 1.

THE CLEVELAND BRIDGE AND ENGINEERING CO. LTD.

Bridge Builders and Constructional Engineers.

SPECIALISTS IN DEEP FOUNDATION WORK.



Sara Bridge over Ganges. 9 spans each 345ft. 0in.

LONDON OFFICE - - - 123, PALL MALL, S.W. 1.
HEAD OFFICE & WORKS - - DARLINGTON.

TELEGRAMS:—
CLEVELAND, DARLINGTON.
CLEBRIDGE, LONDON.

TELEPHONES:—
No. 2710 DARLINGTON.
No. 3437 CENTRAL.

ON ADMIRALTY AND WAR OFFICE LISTS.

Telephone Nos. 4107, 4108 & 4109. Telegraphic Address: "Engineers, Dundee."
Codes used: "A.B.C." (5th Edition), Marconi and Bentley.

TOTALLY ENCLOSED WORM AND SPUR REDUCTION GEARS.

Machine Cut Double Helical Spur Gears.

Machine Moulded and Machine Cut Wheels, any Size and Material. Heavy Haulage Gears. Shafting and Rope Pulleys for Mills and Factories.

MESSRS.
URQUHART LINDSAY & ROBERTSON ORCHAR, LTD.,
ASSOCIATED WITH
FAIRBAIRN LAWSON COMBE BARBOUR, LTD., LEEDS.
ENGINEERS,
BLACKNESS and WALLACE FOUNDRIES
DUNDEE.

MACHINERY

For STEELWORKS, SHIPBUILDING, ENGINEERS, FOUNDRIES, MINES, &c.

LOCOMOTIVES. CRANES.

Contractors' Plant.

BOILERS & TANKS.

Weir Pumps

WINCHES
PIPES.

"ALBION" MACHINERY CATALOGUE 10,000 LOTS. Post free.

RAILS.

STRUCTURAL STEELWORK.

Non-ferrous Metals.

SCRAP IRON & STEEL

Old Works and Obsolete Plant Dismantled.

TARRED & DRY SLAG. COAL, COKE & MINERALS.
CORNISH GRANITE.

THOS. W. WARD LIMITED,
ALBION WORKS, SHEFFIELD.
Telegrams: "FORWARD, SHEFFIELD."
Telephone: 22301 (6 lines).

London Office: 116, Fenchurch Street, E.C.3

Self-Oiling Pump.

100 lbs. pressure.

Totally enclosed oil bath.

Noiseless.

Centrifugal Pumps
Self-Oiling Pumps
Duplex Power Pumps

BELT OR ELECTRIC DRIVE.

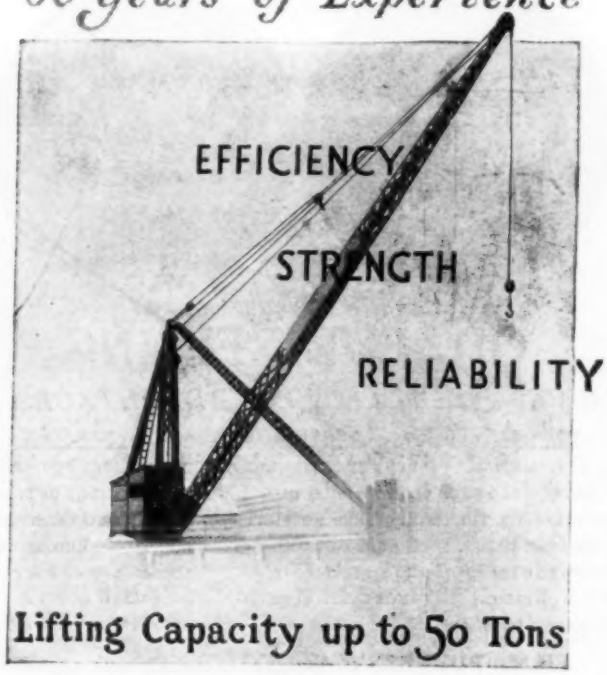
Duplex Steam Pumps.

Pumps for every Duty and Service.

TELL US YOUR PUMPING PROBLEM.

Fairbanks, Morse & Co. Ltd.
87, SOUTHWARK ST. LONDON S.E.1.

"MORGAN"
DERRICK for CRANES
Electric, Steam or Hand Power
60 Years of Experience



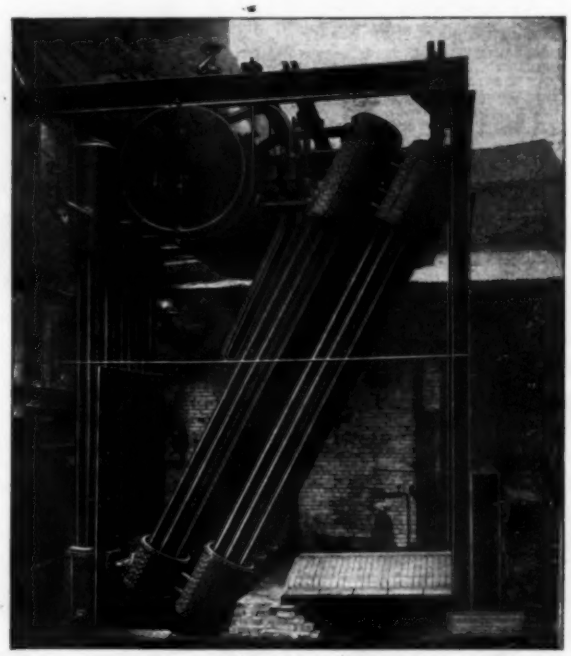
Lifting Capacity up to 50 Tons

Our Cranes are working under all conditions where Derrick Cranes can be used, therefore we Know we can give satisfaction.

Wm Morgan & Co Ltd
EGLINTON ENGINEERING WORKS
EST? 1885.
KILWINNING - SCOTLAND

'NESDRUM' WATER TUBE BOILERS

FOR
COAL, POWDERED FUEL, GAS, WASTE HEAT, OIL, OR REFUSE FIRING.



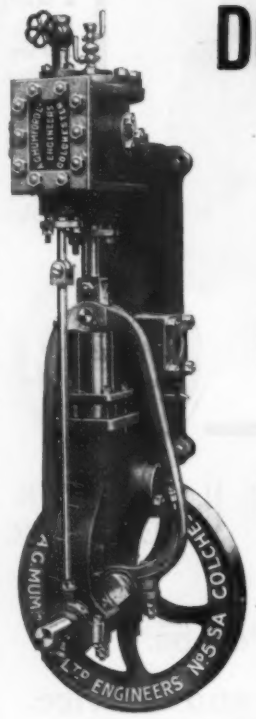
"NESDRUM" BOILER AND SUPERHEATER IN COURSE OF ERECTION.

RICHARDSONS WESTGARTH & Co. LTD.
HARTLEPOOL.
Also Works at MIDDLESBROUGH & SUNDERLAND.
LONDON OFFICE:—121-124, ABBEY HOUSE, 2, VICTORIA ST., S.W.1.
Telephone: VICTORIA 6367. Telegrams: RICHGARCO, SOWEST.

A. G. MUMFORD, Ltd.

'Favorite'

DONKEY PUMPS



WORLD WIDE REPUTATION.

MADE IN **14** SIZES.

SINGLE OR DOUBLE ACTING.

ALSO

DUPLEX & SIMPLEX STEAM PUMPS.

VERTICAL & HORIZONTAL. FOR ALL DUTIES.

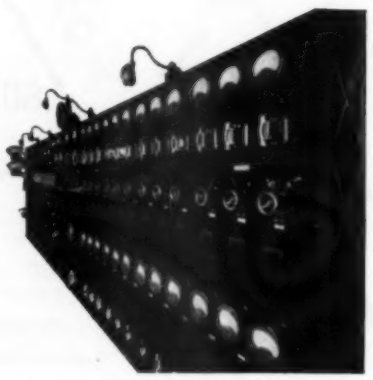
PARTICULARS AND PRICES ON APPLICATION.

CULVER STREET ENGINEERING WORKS, COLCHESTER.

SWITCHBOARDS AND SWITCHGEAR.

Send your requirements to—

DRAKE & GORHAM, LTD.,
Rockingham Works,
Newington Causeway,
London, - S.E. 1.
'Phone : Hop 3330.



3 phase Switchboard supplied to the G. N. Rly. of Ireland dealing with the total power and lighting at Amiens Street Station, Dublin. Total Capacity of Switchboard 2,000 amps. 440 volts.

THE IDEAL ROLLER TABLE

SCHULTE ROLLER TABLE
PATENTED IN GREAT BRITAIN
FITTED WITH INDIVIDUALLY DRIVEN
MOTOR ROLLERS
FOR CONVEYING HOT AND COLD MATERIAL
GREAT SAVING IN POWER, LUBRICANT AND LABOUR, ELIMINATING ALL INTERMEDIATE DRIVING PARTS AND WEAR.
COME AND SEE THIS TABLE IN OPERATION.
SOLE MAKERS:
SCHLOEMANN
AKTIENGESELLSCHAFT
DÜSSELDORF
(GERMANY)
SPECIALISTS IN THE DESIGN OF MODERN ROLLING MILLS

SCHLOEMANN

THE "Filma." SYSTEM

OF

OIL FUEL FIRING

GIVES THE FOLLOWING ADVANTAGES:

BOILERS.	GENERAL.	FURNACES.
HIGH EVAPORATION.	BURNS ANY LIQUID FUEL.	EVEN TEMPERATURE.
LOW FLAME VELOCITY.	BURNS COLD OIL.	FULL CHAMBER OF FLAME.
NO BURNING OF TUBES.	REQUIRES NO FILTERS.	NO BURNING OR SCALING.
NO CARBON DEPOSIT.	NO JET ACTION.	LIGHT ON BRICKWORK.
SHORT SOFT FLAME.	LOW FIRST COST.	LOW FACTOR OF EXCESS AIR.
SILENT WORKING.	SMOKELESS BURNING.	INCREASED OUTPUT.
WIDE RANGE OF LOAD.		NO STANDBY LOSSES.

FILMA BURNERS are designed to operate with either Fan Pressures as low as 4" Water Gauge, by Compressed Air at 3 lbs., or Steam Pressures at 18 lbs.

Burners supplied for all heating purposes and to burn from 0.5 to 75 gallons of Fuel per hour.

Filma Oil Burners Ltd.

68, VICTORIA ST., WESTMINSTER, S.W. 1.

Electric Hoist Blocks.

ASSEMBLED FOR TEST.

"Phec" Patent Electric Hoist Blocks to suit all voltages and conditions. Totally enclosed, with easy access to all parts. 5 cwts. to 5 tons.

Phec

Paterson Hughes

Engineering Company, Limited,
Lochburn Road, Glasgow.

Makers of

Conveyors, Cranes, Runways, Transporters, Elevators, Stackers, Portable Loaders, Winches.

London Office: 180, Windsor House, Victoria Street, S.W.1.
Telephone: VICTORIA 3418.

THE

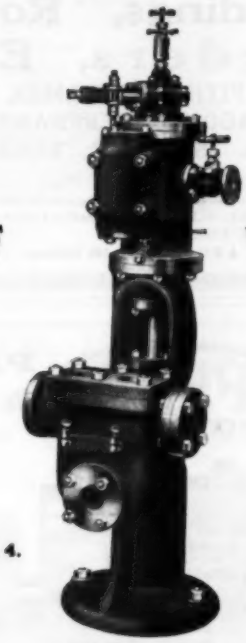
PEARN

Direct Acting Pump

H. W. Pearn's PATENT

DEFINITE LENGTH OF STROKE

HIGH VOLUMETRIC EFFICIENCY



SERIES V.D.P.

London Office:
49, Queen Victoria St., E.C. 4.

Telegrams:
Pumps, Manchester.
Telephone:
2289 Central.

FRANK PEARN & Co LTD MANCHESTER.

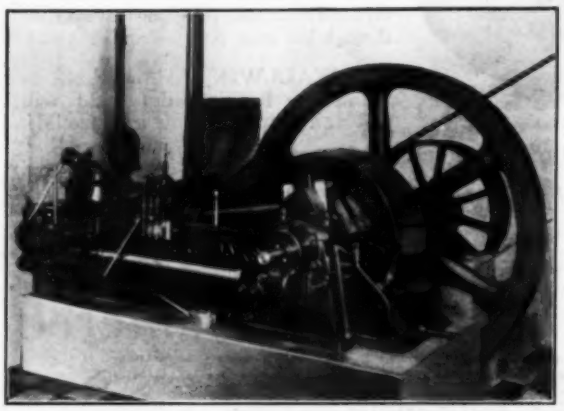
S.E.

SHANKS

Cold Starting Oil Engines

"B" TYPE.

The illustration below shows a Shanks Cold Starting Oil Engine driving machinery on a Scottish Estate.



Single Cylinder, from 12 to 105 B H.P.

Twin Cylinder up to 210 B.H.P.

Owing to their

RELIABILITY and GREAT ECONOMY

these Engines are being extensively introduced for new power plants, and to replace existing Steam, Electric, and other drives.

The economy is such that when this class of Engine is installed to replace almost any other form of power plant, the saving effected frequently pays for the complete installation in a year or two's use.

These Engines run on Fuel Oils up to and exceeding ·95 specific gravity, and will generate power at less than ¼d. per B.H.P. hour.

Apply for Circular B.27.

ALEXANDER SHANKS & SON, Ld.

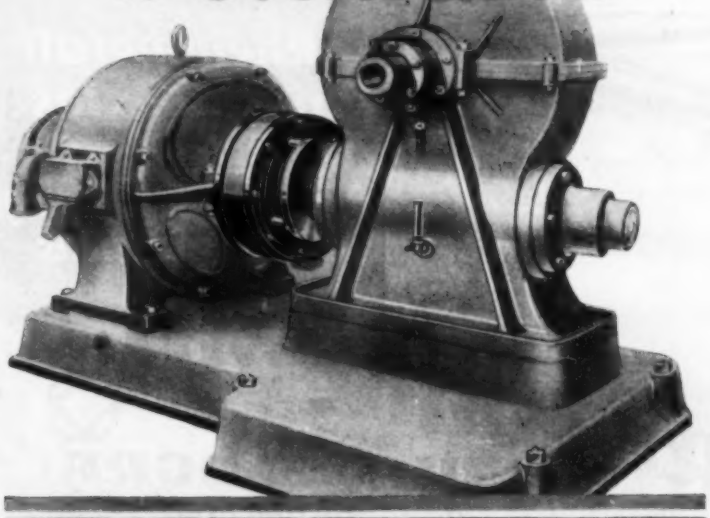
Dens Iron Works, Arbroath, Scotland.

London Office: Bush Lane House, Bush Lane, Cannon Street, E.C. 4.
Telegrams: "Shanks, Arbroath"; "Shankson, Cannon, London."
Telephones: No. 168, Arbroath; No. 8757, City, London.

The HELE-SHAW

SAFETY COUPLING

Prevents the motor "Burning out" if Overloaded



THE BRITISH HELE-SHAW PATENT CLUTCH CO LTD OLDHAM ENGLAND

ALEX. FINDLAY & CO. LTD.

STRUCTURAL ENGINEERS,

MOTHERWELL, SCOTLAND.

Steel Bridgework, Buildings, Roofs, Girders, Etc.

STEEL PITHEAD FRAMES, STEEL
- - WAGON UNDERFRAMES - -
- - OIL STORAGE TANKS - -

Speciality, Stamped Steel Floor Troughing.

Head Office: MOTHERWELL, N.B. London Office: 9, VICTORIA ST., S.W.
Telegrams: "FINDLAY, MOTHERWELL." "PARKNEUK, LONDON."
A B C Code, 4th & 5th Editions.

LONDON— "Clock House," Arundel St., Strand, W.C. 2.
NEWCASTLE-ON-TYNE— 28, St. Mary's Place.
SHEFFIELD— 8 to 10, Smithfield Works, Smithfields.

TRADE MARK EB QUALITY.

MANCHESTER— 67, Barton Arcade.
GLASGOW— 423, St. Vincent Street.
BELFAST— 5, Corporation Street.

ROLLED METALS & TUBES
IN
BRASS, COPPER & NICKEL SILVER,
In all sizes—For all purposes.

BRASS & COPPER
LOCOMOTIVE & CONDENSER TUBES.

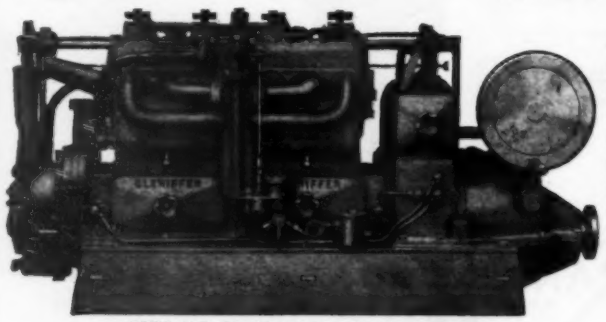
EARLE, BOURNE & CO., LTD.

Established 1874.
Birmingham Rolling and Tube Mills,
Tel. No.—Edg. 2141 (4 lines) and 2379. BIRMINGHAM. Telegrams: "Tub'ng."

GLENIFFER MARINE MOTORS

PARAFFIN & PETROL

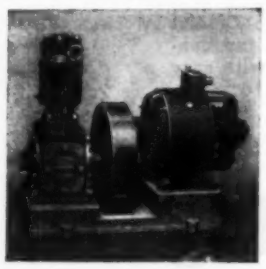
From 12 to 105 H.P.



Suitable for all types of motor craft, also for stationary purposes such as electric generating sets, pumping sets, &c.

28/32 H.P. Paraffin Engine & Reverse Gear.

GLENIFFER MOTORS LTD., ANNIESLAND, GLASGOW.
Telegrams: "GLENGINE, GLASGOW."



Electrically-driven Compressor.

Air Compressors

Capacities from 1 c. ft. to 300 c. ft. free air per minute.
BELT, STEAM, ELECTRIC and OIL DRIVE.

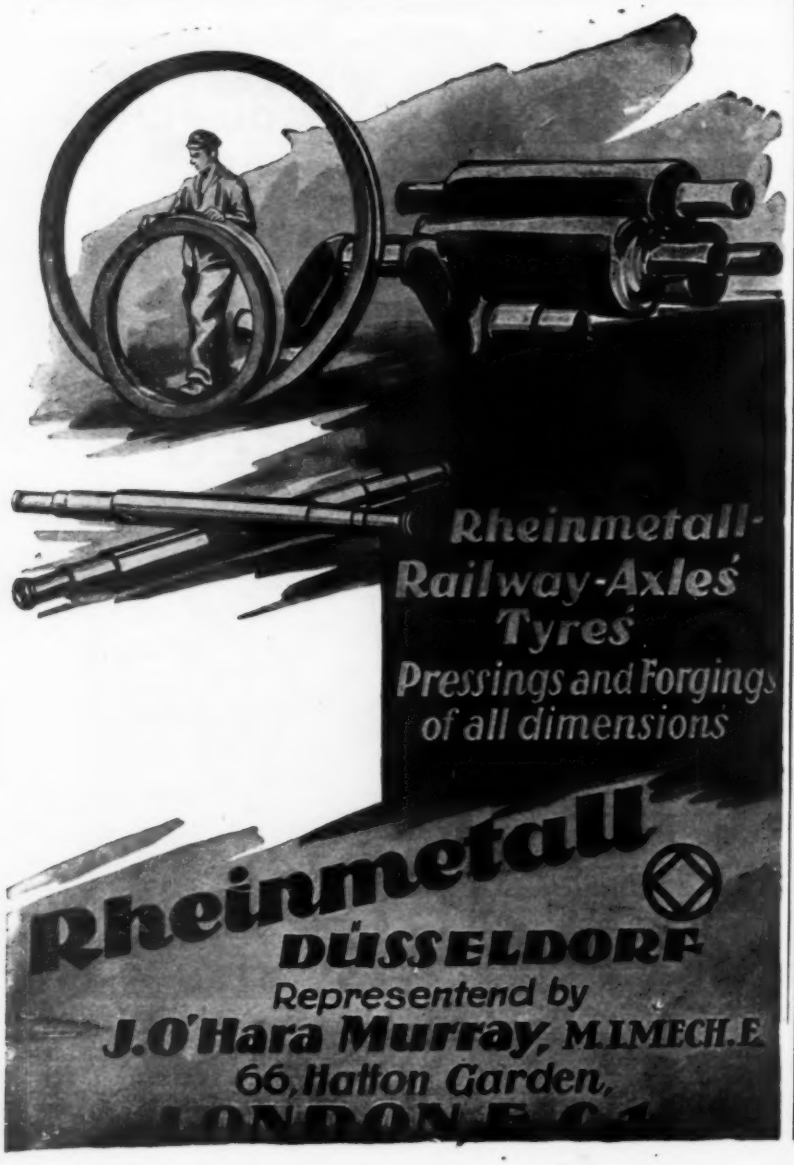
Vacuum Pumps.
DIVING APPARATUS of all patterns
OXYGEN BREATHING APPARATUS
for work in poisonous air.
Smoke Helmets.
Medical Oxygen Apparatus.

IMMEDIATE DELIVERY.

SIEBE, GORMAN AND CO., LTD.,
"NEPTUNE" WORKS and 187, WESTMINSTER BRIDGE ROAD, LONDON, S.E.
Telegrams: "Siebe, Lamb, London." Cables: "Siebe, London." Telephone No.: Hop 3401 (2 lines).

BROWN BAYLEY'S STAINLESS

STAINLESS STEEL & IRON
Made by the Inventor at
BROWN BAYLEY'S STEEL WORKS LTD. SHEFFIELD



WALLWIN PUMPS

(with Patent Impeller)

A Positive Non-Chokeable Impeller.

Have by sheer merit won the highest praise from some of the most important users in this country and abroad for pumping efficiently and without choking

Unscreened Sewage and Sludge.

They will pump continuously Lumps of Hair, Cotton Waste, Dirty Water, Pieces of Rag, Rope and String, Stones, Grit and Sand, etc. Anything that can flow through the inlet pipe will be delivered.

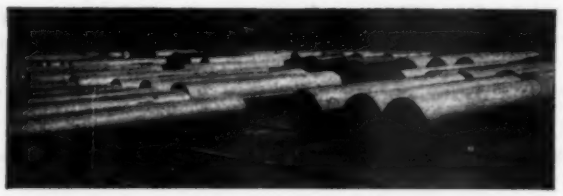
The WALLWIN Pump is built to stand the heaviest duty and will not fail nor give you any trouble.

It is made to do what no other Pump can do.

THE WALLWIN COMPANY *MANUFACTURING — ENGINEERS —*
Saltisford Ironworks, WARWICK, Eng.

Corrosion *can* be countered

The pipes in the illustration, 6½ft. in diameter, form part of the main pipe line for the New York Board of Water Supply. They are protected against Corrosion with BRIGGS' ANTI-CORROSIVE SOLUTION.
Let us advise you about your Corrosion Problems.



BRIGGS' BITUMINOUS COATINGS

WILLIAM BRIGGS AND SONS, LIMITED,
5, Cowgate, DUNDEE.——6, Lloyd's Avenue, London, E.C. 3.

P.B. SILLIMANITE

The HIGH-TEMPERATURE-RESISTING-REFRACTORY.

Should be specified when purchasing BRICKS or SHAPES to be exposed in use to ABNORMALLY HIGH TEMPERATURES, in furnaces of all kinds, whether fired by coal, coal dust or oil. It has a softening point above 1800° C. and is extremely resistant to erosion and variations of temperature.

Full particulars from:

The P.B. SILLIMANITE COMPANY, LIMITED

Sole Agents:

PAWLE & BRELICK, 791, Salisbury House, London Wall,
LONDON, E.C. 2.

Telephone No.: LONDON WALL 4825. Telegrams: PLATOONS, LONDON.

SNAIL BRAND
Drop-Forged Mild Steel Double-Head Spanners.
Erectors' & Platelayers' Spanners.
Drop-Forged Mild Steel Adjustable Wrenches.
Drop-Forged Mild Steel 'S' Spanners.
Thomas Smith & Sons of Saltley Ltd
Saltley Mill. BIRMINGHAM

Their 'Quality' keeps them accurate.

The correct quality of high grade steel of precisely the right temper is *always* used for our

SNAIL BRAND TOOLS.

That is why they remain so accurate and true after years of service. Their economy is only exceeded by their efficiency. Write for complete Lists.

R.H.S.

Telephone: EDGBASTON 2161-2-3. Telegrams: FLASK, BIRMINGHAM.

ELECTRICAL CONDUIT TUBES AND FITTINGS,

ALSO

LOCOMOTIVE TUBES,
SEAMLESS STEEL TUBES,
CONDENSER TUBES.

THE METALLIC SEAMLESS TUBE CO., Ltd.,
WIGGIN STREET, BIRMINGHAM.

REVOLUTIONISE YOUR METAL SAWING

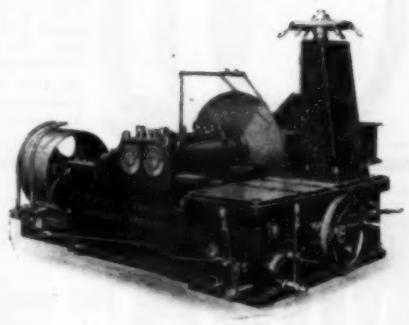
WITH THE

"CLIFDELL" COLD SAWING MACHINE

Actual Cutting Times:

24" × 7¼" JOIST	- -	3 Min.
18" × 6" ,,	- -	2¼ ,,
12" × 6" ,,	- -	1⅞ ,,
6" dia. M.S. BAR	-	2 ,,
90 lb. Bulb Head Rail	- -	¾ ,,

WRITE FOR FURTHER PARTICULARS.



Sole Makers:
CLIFTON & WADDELL,
Johnstone :: Scotland.

NEGRETTI & ZAMBRA

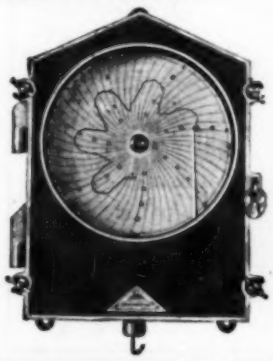
DISTANCE RECORDING THERMOMETERS

with

COMPENSATED CAPILLARY TUBING

for

Flue Gases — Feed Water
Superheaters — Economisers
Steam Pipes — Fuel Oil, etc.



NEGRETTI & ZAMBRA
38, Holborn Viaduct,
LONDON, —— E.C. 1.

NEGRETTI & ZAMBRA

LIFTS

ELECTRIC—HYDRAULIC—HAND.

ALSO ELECTRIC CRANES.

LONDON HOIST CO.,

103, WORSHIP STREET, E.C. 2.

THOMAS TURTON & SONS LTD

MANUFACTURERS OF

ENGINE, CARRIAGE, AND WAGON SPRINGS,
CAST STEEL FILES,
ENGINEERS' TOOLS, HAMMERS, EDGE TOOLS,
STEEL FORGINGS, SPRING STEEL,
TOOL STEEL.

SHEAF WORKS, SHEFFIELD.
LONDON OFFICE: NORFOLK HOUSE, 7, LAURENCE POUNTNEY HILL, E.C.4.

GRAFTON & CO.

CONTRACTORS TO H.M. GOVERNMENT.
ATLAS WORKS,
(Telegrams: GRAFTON, BEDFORD.)
BEDFORD.

Illustrated Descriptive List free on application.

SILVER MEDAL, Inventions Exhibition, London, 1885.
GOLD MEDAL, PARIS, 1900.
GRAND PRIX & GOLD MEDAL, Franco-British Exhibition, London, 1908.
GRAND PRIX, Buenos Aires Exhibition, 1910.

KELVIN MARINE ENGINES

RANGE 3 H.P. TO 60 H.P. PARAFFIN OR PETROL.

OVER 200,000 H.P. IN SERVICE.

These robust and vigorous power units, designed for continuous service at sea, are eminently suitable for a variety of land and stationary services such as driving pumps, dynamos, air compressors, hoists, cranes, etc.

Full details from the manufacturers

THE BERGIUS COMPANY LD., DOBBIE'S LOAN GLASGOW.

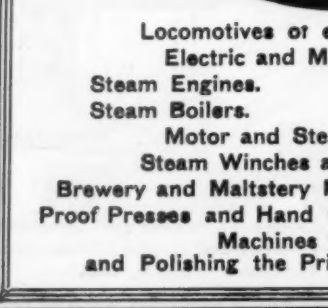
Co-operation is sought with firms desiring to standardise on power units to suit their machine.

To make sure your RINGS are TRUE *buy from*

The Standard Piston Ring and Engineering Co., LTD.,

Premier Works, Don Road, SHEFFIELD.

Telephone: No. 2149. Telegrams: "Ocean" Sheffield



The "STANDARD"

HAMMERED CAST IRON PISTON RINGS

Our Hammered Piston Rings are well and favourably known all over the world for more than 30 years for their efficiency and long wearing qualities. They keep the cylinders round and maintain a perfect joint until worn out. The pressure on the cylinder wall always remains constant.

All sizes 2in. to 72in. diam. In our special quality piston ring iron, giving approximately 14 tons tensile per sq inch.

Quickest Possible Delivery. Lowest Possible Prices.

MICA

F. WIGGINS & SONS.

Telephone: Avenue 2248.

FOR INSULATION, FURNACE SIGHT-HOLES, etc.

Largest Stock in the World.

102, 103, and 104, Minories, LONDON.

IT IS IMPORTANT.

When buying "STAUFFER'S LUBRICANT" –the original high grade machine grease–satisfy yourself that it is the product of TRIER BROS. Ltd., the sole manufacturers & proprietors of the above Reg. Trade Mark.

We frequently come across users of lubricant who consider and therefore use, the word "STAUFFER'S" as a GENERIC TERM for any sort of grease which has similar colour & consistency to our own product.

Naturally, competitors either actively or passively encourage this belief & though imitation is held to be the "sincerest form of flattery," we wish to safeguard both old and new customers against inferior imitation.

Look for the Reg Trade Mark.

"Stauffer's Lubricant"

SOLE MANUFACTURERS:

TRIER BROS. LTD.,

38, Victoria Street, Westminster, S.W.1 & Cumberland Works, Camberwell, S.E. 5.

J. A. MAFFEI,

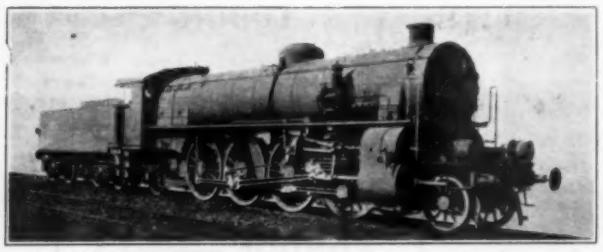
MUNICH, GERMANY.

Locomotives of every kind and size.
Electric and Motor Locomotives.
Steam Engines. Steam Turbines.
Steam Boilers. Electro Steam Boilers.
Motor and Steam Road Rollers.
Steam Winches and Grab Dredgers.
Brewery and Maltstery Plants. Machine Tools.
Proof Presses and Hand Cylinder Printing Machines.
Machines for Grinding and Polishing the Printing Copper Cylinders.

SOCIETA ITALIANA ERNESTO BREDA,

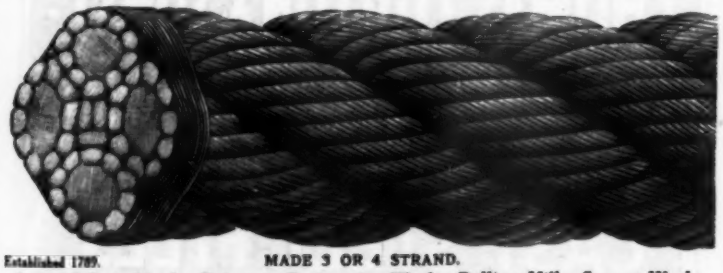
per Costruzioni Meccaniche. MILANO (Italy).

SHARE CAPITAL, lt. £100,000,000. OLD ESTABLISHED FIRM. 6000 OPERATIVES.



STEAM & ELECTRIC LOCO-MOTIVES.
RAILWAY & TRAMWAY ROLLING STOCK.
PORTABLE & THRASHING ENGINES.
ROAD ROLLERS.
&c. &c.

LAMBETH COTTON DRIVING ROPES.



Established 1789. MADE 3 OR 4 STRAND.

Specially suitable for Drives in Engineering Works, Rolling Mills, Cement Works, Textile Factories, and Main Driving Generally.

Book on Rope Driving Free on application.

THOMAS HART Ltd. LAMBETH WORKS **Blackburn, England**

THE MITCHELL CONVEYOR & TRANSPORTER CO., LTD.,

ALL CLASSES OF HANDLING MACHINERY.
45-50, Holborn Viaduct, LONDON, E.C.1.
Grams: Miconatrac, Cent, London.
Phone: Holborn 2032.

WAGON TIPPLERS, TRANSPORTERS, CONVEYORS TELPHERS, CRANES, LOCO. COALING PLANTS GRABS, COMPLETE BOILER HOUSE EQUIPMENT. AERIAL ROPEWAYS.

SOLE AGENTS FOR THE BRITISH EMPIRE FOR CERETTI & TANFANI'S SYSTEM, MILAN

Telegrams: "Pumps, Rodley." Telephone No.: Stanningley 71730.
Codes: A B C, 5th Edition. Marconi International.

The Leeds Engineering & Hydraulic Co.
LIMITED,

RODLEY, LEEDS.

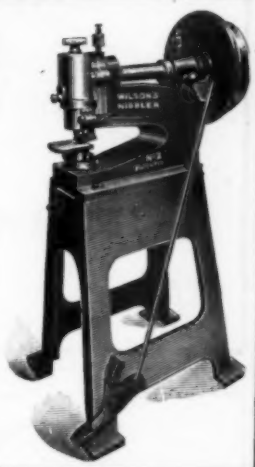
REGISTERED TRADE MARK

MAKERS OF ALL CLASSES
HYDRAULIC MACHINERY, CRANES, LIFTS, HOISTS AND WINDING SETS, &c., &c.

THE STEEL COMPANY OF SCOTLAND, LTD
SIEMENS S.M.S. PROCESS
EST'D HALLSIDE 1872
23, ROYAL EXCHANGE SQUARE, GLASGOW.
WORKS: HALLSIDE, NEWTON, and BLOCHAIRN, GLASGOW.
OFFICES: 23, ROYAL EXCHANGE SQUARE, GLASGOW, and 9, MINCING LANE, LONDON.
CONTRACTORS TO BRITISH ADMIRALTY, WAR DEPARTMENT, & FOREIGN & COLONIAL GOVERNMENTS
Manufacturers of
MILD STEEL Plates for Ships, Boiler and Bridge-building, Angles, Zed Bars, Tees, and all forms of Sectional Bars required for constructive purposes.
CASTINGS of all kinds and largest sizes for Ship Stems, Stern Posts, Anchors, Rudders, &c.
FORGINGS of every description.
AXLES of highest quality, to meet requirements of Home and Colonial Railways.
TYRES—Locomotive Carriage and Wagon, to all requirements.
SPECIAL STEEL of all kinds used for constructive purposes.

PATENT NIBBLING MACHINE
For the rapid cutting of Sheet Metal

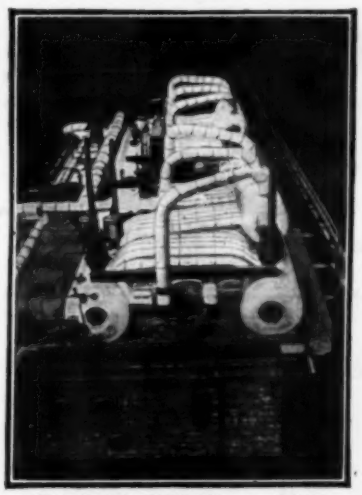
NEW HEAVY TYPE.
Will cut mild steel up to ½" thick.
Lighter types cut up to ⅝" thick.
ALL SIZES IN STOCK.



Write for Catalogue and sample of work.

J. B. STONE & CO. LTD.
135, Finsbury Pavement,
LONDON, E.C. 2.

Fuel Economy
by Insulation.



We specialise in the efficient insulation of Boilers, Steam and Feed Pipes, Turbines, and all Steam Generating Plant, etc.

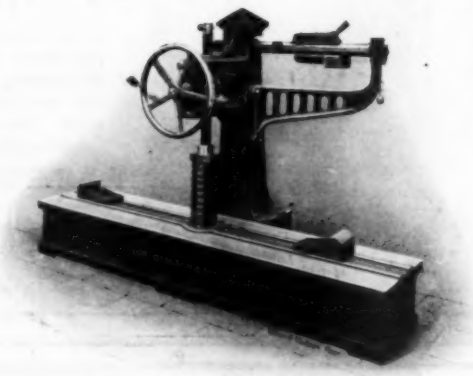
ILLUSTRATED BROCHURE ON REQUEST.

INSULATION SUPPLIED & FIXED BY HOBDELL, WAY & CO., LTD.

HOBDELL, WAY & Co. Ltd.
45, CHURCH ST., MINORIES,
LONDON, E. 1.
Telephones:—ROYAL 8022 (4 lines).
Telegrams:—"HOBNAILS, ALD., LONDON."

THE
"DENISON" SPRING TESTER

Also made for POWER DRIVE BY BELT, ELECTRIC MOTOR, HYDRAULIC MAIN AND OIL TRANSMISSION SYSTEM.



MADE IN VARIOUS CAPACITIES.

SUITABLE FOR TESTING IN COMPRESSION AND TENSION
HAND OPERATED.

SAML. DENISON & SON LTD., PARKSIDE, LEEDS.

Stern Wheel Steamers,
Ocean Cable Steamers,
Gold Dredgers.

Bucket and Suction Dredgers of all sizes

LOBNITZ & CO., LTD.
Engineers & Shipbuilders,
RENFREW, SCOTLAND.

Telegrams: "LOBNITZ, RENFREW."

Sole Makers of Patent Rockbreaker for rock excavation under water without explosives.

THE SIGN OF QUALITY
THIS TRADE HYSON MARK ON
ANY VALVE, BOILER MOUNTING OR PRESSURE GAUGE.
BY
SMITH BROS. & CO. (HYSON), LTD.,
Telephone: 1816. NOTTINGHAM. Telegrams: "HYSON."

DAVIE & HORNE, LTD., JOHNSTONE, nr. GLASGOW.
Telephone: Johnstone 51. Tels.: Evaporator, Johnstone.

MAKERS OF "DAVIE'S".
Sea Water EVAPORATORS,
Fresh Water DISTILLING PLANTS,
Feed Water FILTERS & HEATERS,
CONDENSING PLANTS & CENTRIFUGAL PUMPS.

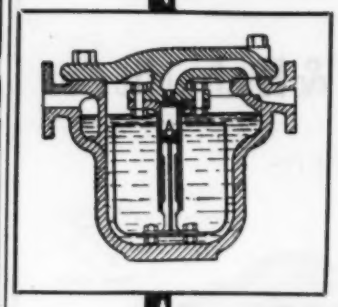
LONDON OFFICE: 5, FENCHURCH ST., E.C. 3.

LEAD PIPE MAKING MACHINERY.

SHEET LEAD ROLLING MILLS.

THE ECLIPSE TOOL COY.

LINWOOD, NEAR GLASGOW.



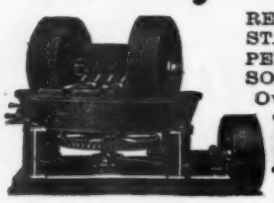
Steam Traps

We are specialists in the manufacture of flanged pipe work and accessories for the Power House.

AITON & CO. LTD. DERBY.

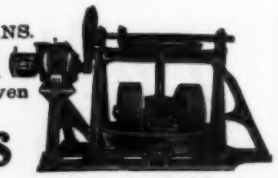
Pipes for all Purposes and for all Pressures.

Smedley Brothers Ltd., BELPER, DERBYSHIRE, ENGLAND.



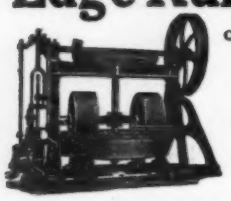
REVOLVING or STATIONARY PANS. PERFORATED or SOLID BOTTOMS. Over or Underdriven

Mixers

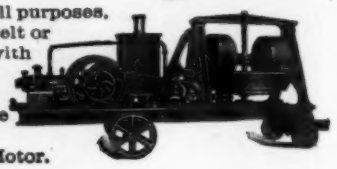


AND

Edge Runner Grinding Mills



of all kinds for all purposes, to drive by Belt or combined with Steam, Oil or Petrol Engine or Electric Motor.



DOUBLE HELICAL GEARS

FOR

ALL PURPOSES.

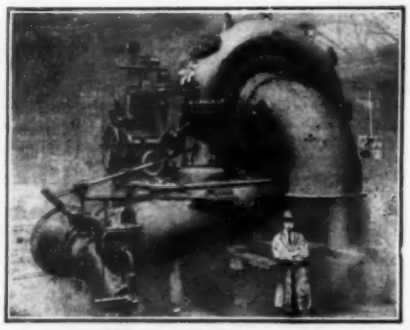
Write for New Catalogue.

TURBINE GEARS LTD.,

HYDE.

'Phone: 41 Hyde.
'Grams: Gears Hyde.

BOVING & CO., Ltd.



6 Units of 5600 B.H.P. each, supplied to the Mysore Government, India.

WATER TURBINES,

PIPE LINES, ETC.

AND

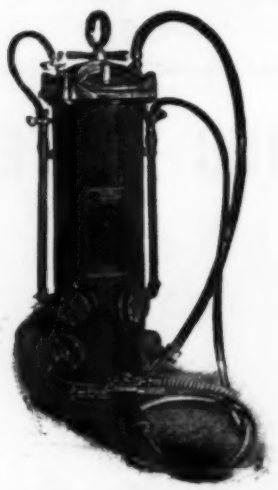
PULP & PAPER

MAKING MACHINERY.

HEAD OFFICE:

56, KINGSWAY, LONDON, W.C. 2.

Telephone: Holborn 0420 (3 lines). Telegrams: Jenorton, Phone, London.



PAINTING

New Model (Patent)

AEROSTYLE

Portable

Paint Sprayer

Self-contained with Air Receiver for Steadying Pressure, Reducing Valves for paint and air feeds, and Paint Container. Weighs only 60 lbs.

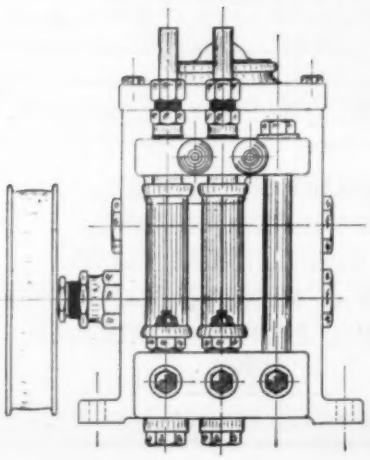
THE MOST EFFICIENT MECHANICAL PAINTER.

Write for particulars:—

AEROSTYLE Ltd., 174-176, St. John Street, ENGINEERS, Clerkenwell, LONDON, E.C. 1.

Telegrams: "Aerostyle Smith London." Telephone: Clerkenwell 7963
Code: Marconi International.

EMPIRE PATENT "DIRECT" LUBRICATORS FOR DIESEL AND OTHER ENGINES.



ALL BRITISH MADE.

Also supplied with DIRECT LEVER and RATCHET DRIVES.

◆

HAVE YOU ANY LUBRICATION PROBLEMS?

THEN WRITE TO

EMPIRE ENGINEERING CO. (MANCHESTER), LTD., EMPIRE WORKS, SALFORD, MANCHESTER.

Telegrams: "Appliances" Manchester. Telephone No.: 339 Pendleton.

THE STEEL PIPE COMPANY, LTD., KIRKCALDY, N.B.

MILD STEEL PIPING FOR:

Exhaust Steam & Circulating Water, Pipe Lines for Water Power, Sewage, Suction and Discharge, Gas and Tar Mains, Air Blast, &c., &c.

Tanks, Air Receivers, Condenser Shells, Expansion Joints, Oil Boilers, Jacketted Pans, Crystallizer Shells, and Mild Steel Chimneys.

SPECIAL PIPES FOR ELECTRIC STATIONS.

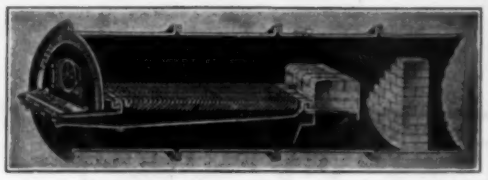
Angle Flanges and Stamped Steel Flanges.

TELEGRAMS: "AQUILENTUS KIRKCALDY."

LONDON AGENTS:
John Wilson (London), Ltd., 39, Lime Street, E.C. 3.

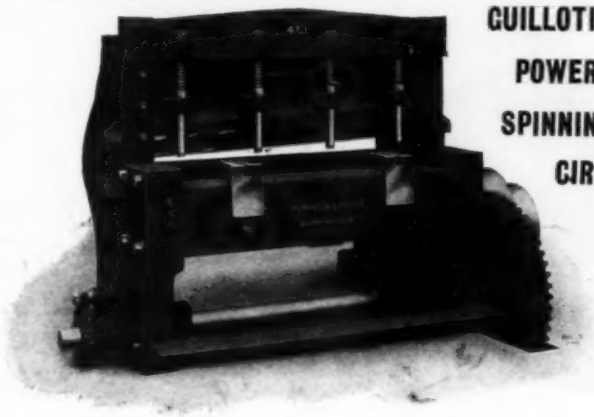
For real FUEL economy fit the

"TURBINE" FURNACE



THIS remarkable Furnace is being fitted to all types of boilers to burn all grades of fuel in factories all over the world. It is effecting fuel economies up to 50 per cent. in leading industries and has made possible the consumption of fuels and waste products —hitherto regarded as useless—with bright, evenly-burning fires. The Furnace can be easily installed and the upkeep is negligible. May we discuss your own requirements? Send for brochure of users' reports and technical data.

THE TURBINE FURNACE CO. LTD.
(Dept. E.),
238 b, GRAY'S INN ROAD, LONDON, W.C. 1.



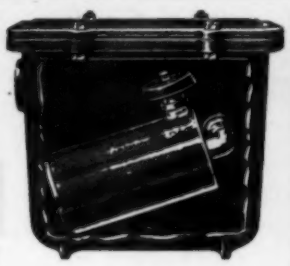
GUILLOTINE SHEARS.
POWER PRESSES.
SPINNING LATHES.
CIRCULAR SHEARS.
HORDERN'S PATENT POWER PRESS SAFETY GUARDS, Etc. Etc.

HORDERN, MASON & EDWARDS, Ltd.,
Power Press Engineers,
TELEPHONE— CENT. 3527. Vesey Street, BIRMINGHAM.

TUBES & SECTIONS in STEEL

THE BRITANNIA TUBE Co LD.,
GLOVER ST.,
BIRMINGHAM.

ROUND TUBES UP TO 6" DIAMETER
FROM 14 TO 20 GAUGE.

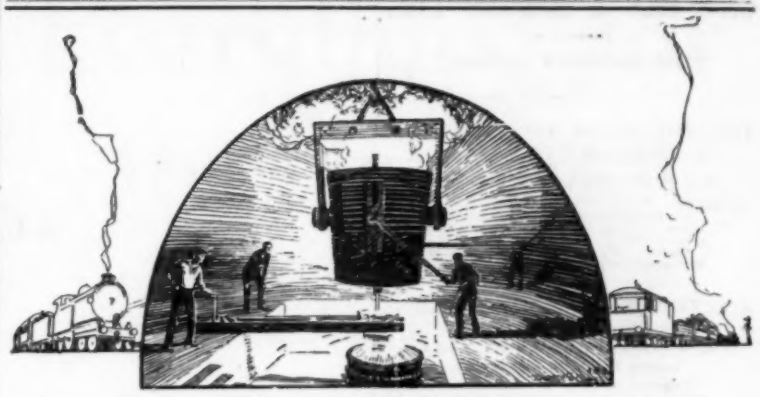


Sole Makers of
"The Lancaster" Pistons, Piston Rings, Metallic Packings, Machine Moulded Wheels.

"THE LANCASTER"
STEAM TRAPS

A patent adjustable air valve fitted to the top of the float entirely overcomes the trouble due to the re-evaporation of water at high temperatures, and water at any temperature up to that of the steam from which it is drained can be efficiently cleared from the pipes or vessel to be drained.

LANCASTER & TONGE, LTD.
PENDLETON, MANCHESTER.
TELEGRAMS "PISTONS" M/C. TELEPHONE PENDLETON 784



The **DAVIS STEEL WHEEL**

'Mileage without Maintenance."

THE Davis Steel Wheel is a one-piece wheel with a tough, wear resisting manganese steel tread integral with a soft safe centre.

The Davis Steel Wheel is fluid compressed by centrifugal casting and scientifically heat treated. A lighter, yet stronger "One-Wear" Wheel, which entirely eliminates tyre turning.

Write for a complimentary copy of the "Davis Steel Wheel Booklet," which explains how the Davis Wheel gives maximum mileage with minimum maintenance costs.

The Davis Steel Wheel is made in England by:

JOHN BROWN & COMPANY LIMITED.
ATLAS WORKS, SHEFFIELD.

I.P.S.—1

On Admiralty and War Office Lists.

LEROY'S COMPOSITION,

For Coating Boilers, Steam Pipes, &c.

Prevents the radiation of heat, saves fuel, and increases the power of Steam.
It is reckoned the cost of the covering is saved in about six months.
— ALSO —
Asbestos Composition, Asbestos Mattresses, Asbestos Rope, Silicate Cotton, Plastic and Sectional Magnesia Coverings.
Established 1865.

F. LEROY & CO., LTD. 10, Gray Street, Commercial Rd., London, E.1
AND AT MANCHESTER.

WHAT INDUSTRY OWES TO CHEMICAL SCIENCE.
Cr. 8vo. 3s. 6d. net.
By RICHARD B. PILCHER & FRANK BUTLER-JONES, B.A. (Cantab.), A.I.C.
WITH AN INTRODUCTION BY
Sir GEORGE BEILBY, LL.D., F.R.S.
CONSTABLE & CO., Ltd., 10, Orange Street, London, W.C. 2.

THE BRAITHWAITE
PRESSED STEEL TANK
BRAITHWAITE & CO. ENGINEERS LTD.
15, BROADWAY BUILDINGS, S.W.1.

CRANES
Derrick & Overhead Travelling Cranes
Worked by Hand, Power and Electric.
JOHN SMITH (Keighley), LTD.
See last week's advertisement, page 4.

CRANES - ALL TYPES
HANDLING MACHINERY
JOHN M. HENDERSON & Co. Ltd.
ABERDEEN

CONSTABLE & COMPANY LTD.,
Publishers of
"THE ENGINEER LIBRARY."

THE PRODUCTION AND TREATMENT OF VEGETABLE OILS.
By T. W. CHALMERS, B.Sc., A.M.I. Mech. E.
Imperial 8vo. Folding Plates and Illustrations. 21 - net.
THE ENGLISH MECHANIC.—"A valuable contribution to our knowledge of the subject from the engineer's point of view."
NATURE.—"A solid piece of work of much use to the vegetable oil industries."

ELECTRIC WELDING AND WELDING APPLIANCES.
By H. CARPMAEL, A.M. Inst. C.E., A.I.E.E.
Imperial 8vo. Illustrated. 18/- net.
TECHNICAL REVIEW.—"A most valuable and broad survey of an industrial field in which there are possibilities of great developments."

WHAT INDUSTRY OWES TO CHEMICAL SCIENCE.
By RICHARD B. PILCHER and FRANK BUTLER JONES, B.A. With an introduction by SIR GEORGE BEILBY, LL.D., F.R.S. Crown 8vo. 4s. net.

THE GYROSCOPIC COMPASS.
By T. W. CHALMERS, B.Sc. A.M.I. Mech. E.
Demy 8vo. Illustrated. 12/ net.

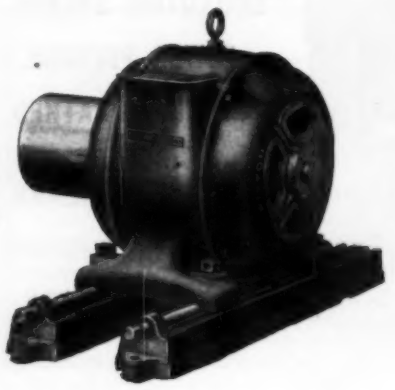
PAPER-MAKING AND ITS MACHINERY.
By T. W. CHALMERS, B.Sc., A.M.I. Mech. E.
Imperial 8vo. Illustrated. 26/- net.
NATURE.—"We are glad to recommend it to those associated with the paper industry."

A NEW VOLUME.
DEVELOPMENTS IN POWER STATION DESIGN.
By H. AUSTIN.
Imp. 8vo. Illustrated. 31s. 6d.

CONSTABLE & CO., LTD.,
10-12, ORANGE STREET, W.C.2.

HIGGS (HM) MOTORS
WITTON BIRMINGHAM

A.C. D.C.



When looking through the long lists of second-hand machines one seldom sees a HIGGS MOTOR offered; the only conclusion one can come to is that owing to the sound construction and excellent performance there is always a ready market for them.
On the rare occasions that they are offered the price asked closely approaches to-day's new price.
This important fact should be borne in mind when purchasing.

To Manufacturers.

An excellent market is open to you for your machines and tools in Italy, if you will familiarise manufacturers and buyers in that country with them.
The improved internal conditions and the economic situation, which is daily becoming stronger, offer a favourable opportunity for re-establishing business relations with foreign countries.

THE BEST WAY TO SELL YOUR PRODUCTS IN ITALY

is through the use of the advertisement columns, which we place at your disposal, in our publications:—

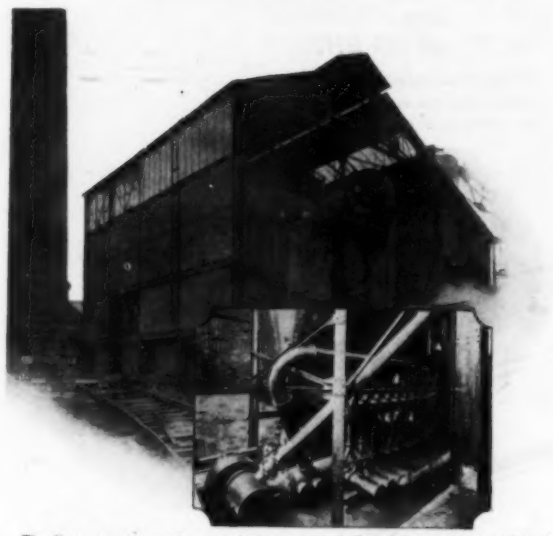
L'INDUSTRIA, a technical review, published fortnightly, of 36 years' standing, and which circulates throughout the offices and works of Italy. Yearly subscription: Francs (French) 60.

LA SERA, the principal evening paper of Milan, a city of 800,000 inhabitants and Italy's commercial and industrial centre. Yearly subscription: Francs (French) 68.

Specimen copies and advertisement rates will be forwarded, free of any obligation, on application to:

SOC. EDITRICE UNITAS (Sect. P.O.), 12, Viale Monforte, MILAN (Italie).

PULVERISED FUEL PLANT.



The illustration shows a Fraser & Chalmers Holbeck Central System Pulverised Fuel plant in final stages of completion. This plant is being installed in a large Yorkshire colliery, and is for firing three water-tube boilers, each of 45,000 lbs. per hour evaporation.

The most efficient use of all grades of coal for power purposes is ensured by pulverised fuel plant.

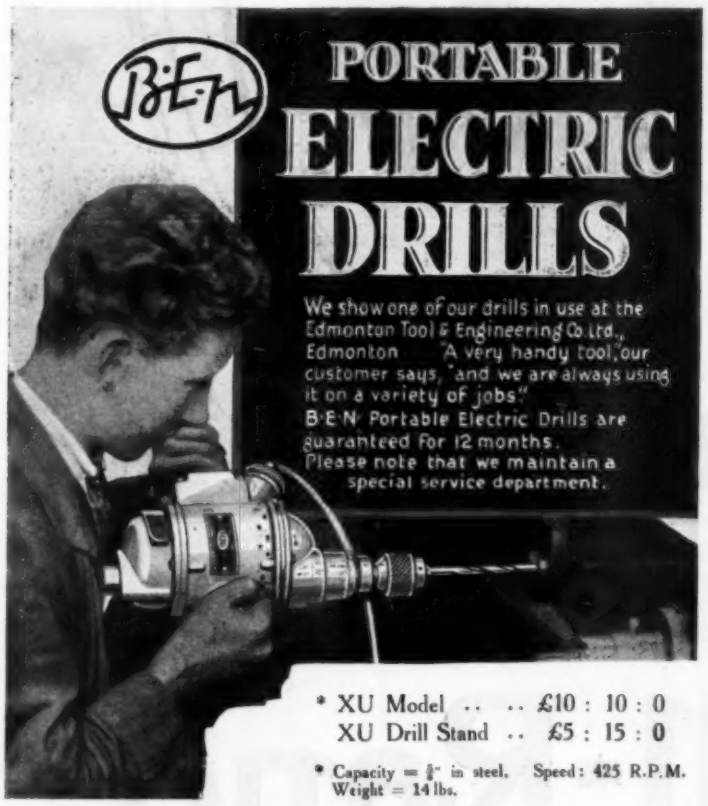
By this means waste is almost entirely eliminated.

Not only does it enable inferior coal to be used, but distribution is simplified and a corresponding reduction in labour costs is obtained.

FRASER & CHALMERS ENGINEERING WORKS

ERITH KENT.

LONDON OFFICE: **Magnet House, Kingsway, W.C. 2.**


B·E·N
PORTABLE
ELECTRIC
DRILLS
We show one of our drills in use at the Edmonton Tool & Engineering Co Ltd., Edmonton. "A very handy tool," our customer says, "and we are always using it on a variety of jobs."
B·E·N Portable Electric Drills are guaranteed for 12 months.
Please note that we maintain a special service department.

* XU Model .. .. £10 : 10 : 0
XU Drill Stand .. £5 : 15 : 0

* Capacity = ⅜" in steel. Speed: 425 R.P.M. Weight = 14 lbs.

The B.E.N. Patents Ltd.

92, Tottenham Court Road, LONDON, W. 1.

Telephone: Museum 1761-2.

B·E·N PORTABLE ELECTRIC TOOLS

Everything for the Drawing Office

OUR KNOWLEDGE OF DRAWING OFFICE requirements results from thirty years' study, during which time we have been responsible for many progressive developments, notably the electric photo-copier.

Let us know your wants. We are ready to supply them from the humble drawing pin to the complete equipment for an up-to-date drawing office.

Sole distributing agents for

TRACING CLOTHS.

Made in four grades.

MANSFIELD - WINCHESTER
STIRLING - CLYDE
(BRITISH MADE.)

B·J·HALL & Co., LTD.

Head Office - - CHALFONT HOUSE, GT. PETER STREET, WESTMINSTER, LONDON, S.W. 1.

Branches:

23, Victoria Street - - S.W. 1.
3, Bond Court, Walbrook, E.C. 4.
Norfolk House, Norfolk St., W.C. 2.

BIRMINGHAM:
32, Paradise Street.

GLASGOW:
Baltic Chambers, 50, Wellington St.

NEWCASTLE-ON-TYNE:
Emerson Chambers, Blackett Street.

M11

RELIABLE—EFFICIENT

Carels-Ingersoll-Rand

OIL ENGINES

Here is a modern four-cycle engine designed for hard, steady service, where reliability is of extreme importance.

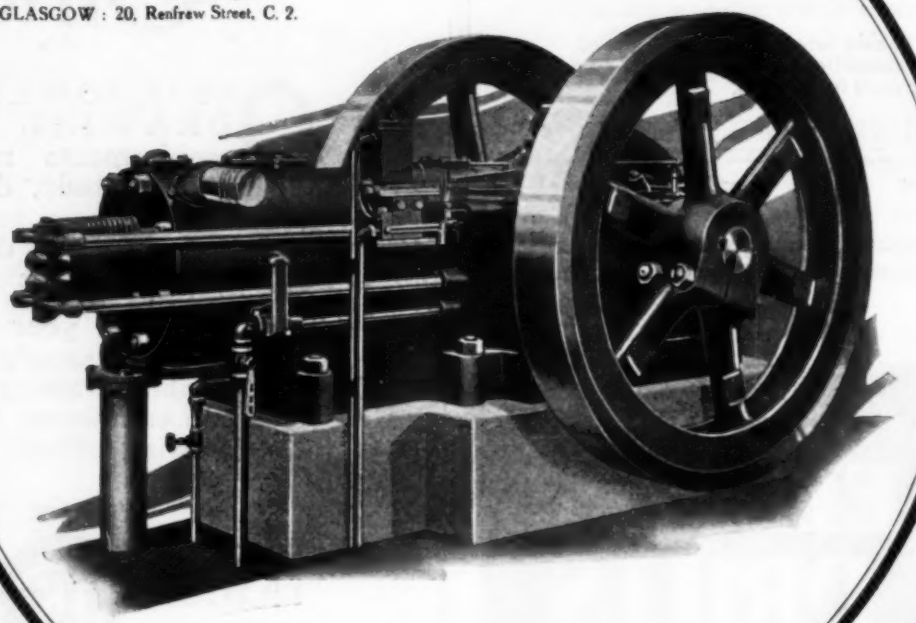
Solid injection of fuel oil is employed. The oil is injected into a water-cooled combustion chamber by *two* opposed spray nozzles. Ignition is by heat of compression only. No torches, electrical ignition or patent plugs are required during starting or running periods.

A pressure feed system for lubricating all moving parts results in a remarkably low consumption of lubricating oil. A 50 BHP. engine will run 50 hours on a gallon.

Send for illustrated Booklet CIR-4.

INGERSOLL-RAND COMPANY Ltd.
165, Queen Victoria Street, London, E.C. 4.
MANCHESTER: 196, Deansgate.
GLASGOW: 20, Renfrew Street, C. 2.

Sizes:
50, 75 and 105 BHP.
Also furnished with direct-connected air compressors or ammonia compressors



IR

Ingersoll-Rand

SUCTION HOSE AND HOSES

for all purposes

We specialise in the manufacturing of large diameter Hoses up to **40 inches diameter,** and for any purpose where a flexible connection is required for Suction or Delivery.

We design and make the necessary Couplings and Flanges for the various types of Hoses.

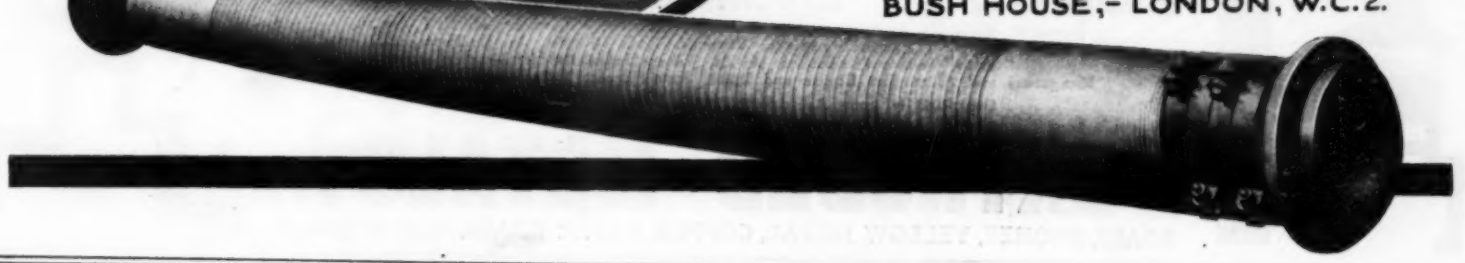
Reddaway's Salvage Suction and Dredging Hoses are used in every part of the World.

Illustration shows part of an order for Reddaway Suction Hose for the conveying of Molasses.

F. REDDAWAY & Co. LTD

PENDLETON, — MANCHESTER.

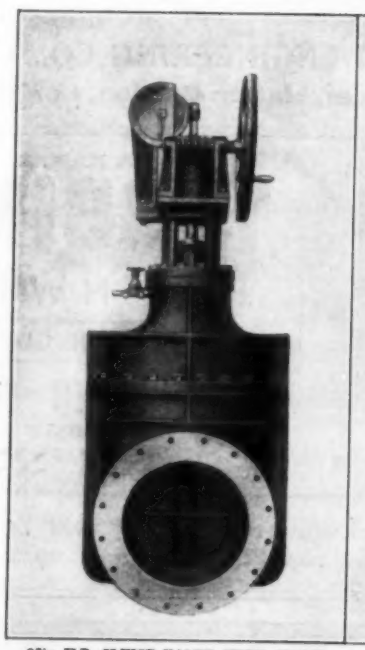
BUSH HOUSE, — LONDON, W.C.2.



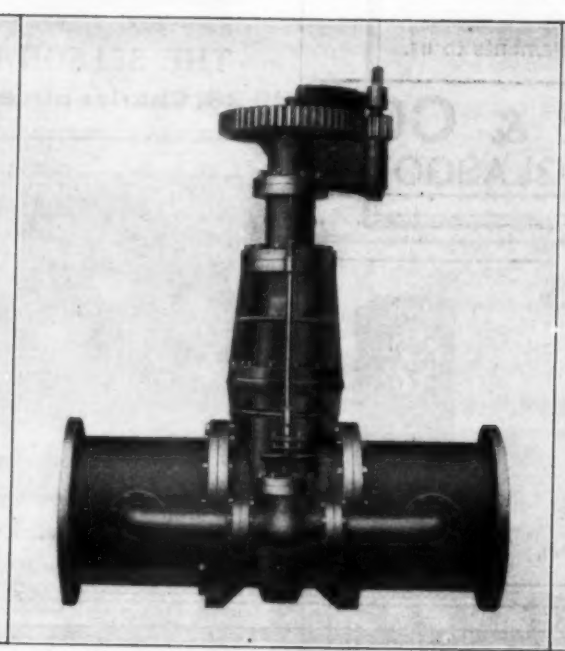
SENTINEL VALVES

AS SUPPLIED TO THE

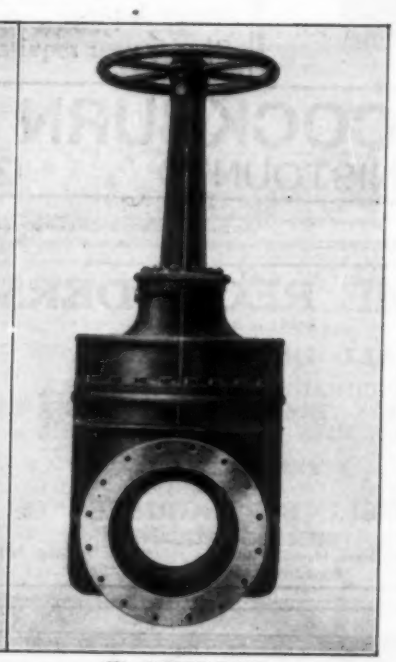
DERWENT VALLEY WATER BOARD.



20in. H.P. SLUICE VALVE WITH WORM GEARING AND INDICATOR.



20in. H.P. SLUICE VALVE WITH SPUR GEARING, INDICATOR AND 4in. BYE-PASS VALVE.



20in. ORIFICE VALVE WITH OUTSIDE SCREW.

ALLEY & MACLELLAN LTD

SENTINEL VALVE WORKS

WORCESTER

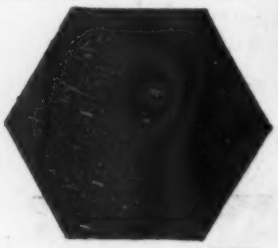
'Phone: Worcester 15.

'Grams: "Alley, Worcester."

AIR COMPRESSORS MADE AT SENTINEL WORKS, GLASGOW.

Rice & Cº (Leeds) Ltd. Telephone 26305
Leeds. Telegrams. Press. Leeds.

HYDRAULIC TOOLS



THE DELTA METAL CO., Limited.

DELTA WORKS, EAST GREENWICH, LONDON, S.E. 10.
(And Delta Works, Dartmouth Street, Birmingham.)
On the lists of the Admiralty, Air Ministry, War Office, Ministry of Munitions, India Office, Post Office, Crown Agents for the Colonies, Principal Railway and Steamship Companies, &c.

SOLE MANUFACTURERS OF **"DELTA" BRAND** Regd. Trade Mark.

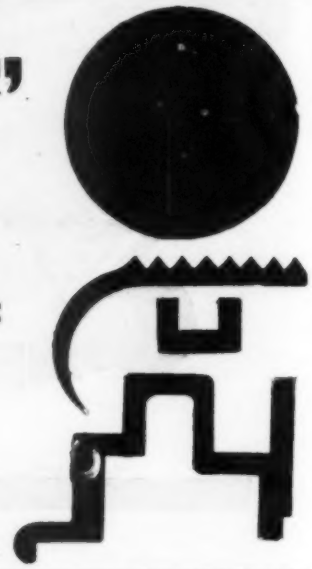
HIGH-CLASS ENGINEERING ALLOYS:

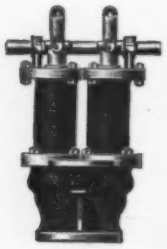
Strongest Malleable Bronzes. Acid-proof and other Corrosion-resisting Alloys.
Ingots, Billets, Forgings, Stampings, Castings, Rods, Sheets, Wire, Tubes, &c.
"Delta" White Antifriction Metals, White Brass, Babbitt Metal, &c.
Manganese and Aluminium Bronze and Brass, Naval Brass, Yellow Metal, Copper, &c.
Supplied to pass Admiralty Tests or other Specifications.

ORIGINAL AND LARGEST MANUFACTURERS OF

EXTRUDED METALS:

BRASS, BRONZE, YELLOW METAL, COPPER, NAVAL BRASS, RED METAL, &c.





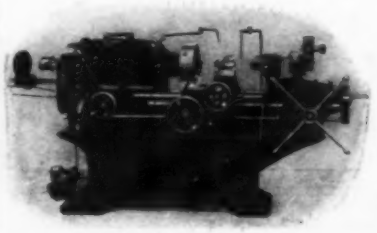
Our sole specialty is

VALVES FOR ALL PURPOSES

To pass the requirements of Boiler Insurance Companies, Classification Surveys and India Boiler Laws.

Specify your requirements to us.

A. COCKBURN & CO.
DENNISTOUN GLASGOW.

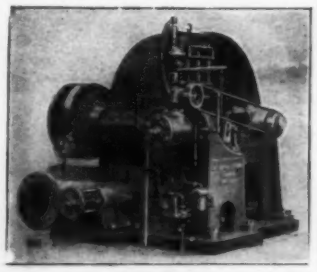


To Prospective Machine Tool Purchasers.

Before considering alleged bargains in obsolete or second-hand machinery, write for our latest catalogue and priced stock list of up-to-date tools. All new—with our full guarantee.

THE SELSON ENGINEERING CO., LTD.,
26/28, Charles Street, Hatton Garden, London, E.C.1.

TIME RECORDERS
ENGLISH MADE
ALL DESCRIPTIONS.
WATCHMAN'S TELL-TALE CLOCKS, CHECK THE ROUNDS OF YOUR WATCHMEN AND PATROLMEN.
SEND FOR LIST.
LLEWELIN'S MACHINE CO.,
BRISTOL, ENGLAND.
Telegrams and Cables: Llewellins, Bristol. 'Phone: 3091.
See different Advert. each week.



PELTON WHEEL & GOVERNOR

WATER **TURBINES** AND PELTON WHEELS
OIL PRESSURE GOVERNORS
W. GUNTHER & SONS,
CENTRAL ENGINEERING WORKS,
OLDHAM.

A copy of "The Engineer Directory" will be sent on application.

AL **ELECTRIC WELDING EQUIPMENT** DA
(ELECTRIC ARC AND ELECTRIC RESISTANCE)
'Phone VICTORIA 9226 Allen-Liversidge, Ltd VICTORIA STATION HOUSE SW1 Telegrams ACETERATOR-SOWEST-LONDON

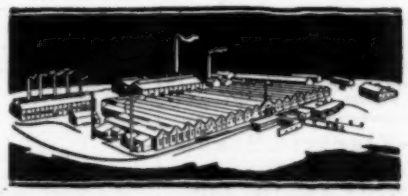
INDEX TO ADVERTISEMENTS.

	PAGE
Accles & Pollock, Ltd	42
Aerostyle, Ltd.	94
Alton & Co., Ltd	94
Albion Motor Car Co., Ltd.	19
Alexander, H., & Co., Ltd	44
Allan, T., & Sons, Ltd	53
Alien-Liversidge Ltd	100
Alley & MacLellan, Ltd	99
Alloy Welding Processes, Ltd	61
Anderston Foundry Co. Ltd	45
Armstrong, Stevens & Son	75
Armstrong, Whitworth & Co., Ld.	40
Ash, J., & Son	60
Ashworth, Son & Co., Ld	79
Asquith, W., Ltd	8
Associated British Machine Tool Makers, Ld	14-15
Avery, W. & T., Ltd	69
Avonside Engine Co., Ltd	80
Axene Ld	11
Bagnall, W. G., Ld	76
Bailey, Sir W. H., & Co., Ld	32
Baldwins Limited	31
Banbury, G. P.	79
Baxter, W. H., Ld	102
Beardmore, W., & Co., Ld	64
Beebee, A.	83
Beldam Packing & Rubber Co	83
Bellis & Morcom, Ld	83
Bennett & Sayer	60
Bennis, Ed., & Co., Ld	26
B.E.N. Patents, Ld	97
Bergius Co., Ld	92
Bernon-Walker Co., Ld	6
Bertrams Limited	60
Beyer, Peacock & Co., Ld	81
Birm'ham Battery & Metal Co	60
Bliss, E. W., Co	84
Boby, W., & Co., Ld	63
Boulton & Paul, Ld	85-86
Boving & Co., Ld	94
Boyle, Robt., & Son	53
Braby, F., & Co., Ld	53
Brackett, F. W., & Co. Ld	66
Braithwaite & Co., Ld	96
Brett's Patent Lifter Co., Ld	64
Briggs, W., & Sons, Ld	90
Britannia Tube Co., Ld	96
British Electric Transformer Co., Ld	26
Brit. Hole-Shaw Clutch Co.	89
Brit. Nicianase Boiler Co., Ld	6
British Oxygen Co., Ld	23
Brit. Piston Ring Co., Ld	41
British Ropeway Eng. Co	60
Brit. Steam Specialties, Ld	45
British Steel Piling Co., Ld	70
British Thomson-Houston Co., Ld	34-35-36-37
Broadbent, R., & Son, Ld	60
Broadbent, T. & Sons Ld	25
Bromford Tube Co., Ld	7
Brookes (Oldbury), Ld	45
Brooke Tool Mfg. Co., Ld	43
Brotherhood, P.	82
Brown Bayley's Steel Works	90
Brownlee, W. E., & Co	60
Brown, J., & Co., Ld., Sheff'd	95
Brownlie & Murray, Ld	60
Bruce Peebles & Co., Ld	19
Bucyrus Company	83
Budenberg Gauge Co., Ld.	64
Burckhardt Eng'g Works	6
Burdions Limited	79
Butcher, Hall & Co	2-102
Butler Machine Tool Co., Ld	14
Butters Bros. & Co	67
Cammell, Laird & Co., Ld.	102
Campbells & Hunter, Ld.	102
Carron Company	5
Cashmore, J.	4
Caterpillar Tractor Co.	4
Cement Marketing Co., Ld	55
Chapman & Hall, Ld	102
Chemical Eng'g & Wilton's Patent Furnace Co., Ld	3
Clarkson	102
Clayton & Shuttleworth, Ld	41
Clayton, Son & Co., Ld	39
Cleveland Bridge & Eng'g Co	86
Clifton & Waddell	91
Clyde Crane & Engineering Co., Ld.	80
Clydestructural Iron Co., Ld	83
Clyne Engineering Co., Ld	66
Cochrane & Co., Ld	10
Cockburn, A., & Co	100
Cohen, G., & Sons Ld	2
Coil Clutch Co., Ld	66
Coles, H. J., Ld	83
Colville, D., & Sons, Ld	79
Consolidated Pneumatic Tool Co	18
Conveyor & Elevator Co	7
Coventry Chain Co., Ld	42
Crane-Benner, Ld	62
Craven Bros. (Manchester) Ld	81
Crompton & Co., Ld	65
Danks, Alfred, Ld	82
Danks, H. & T., Ld	41
Darlington Forge Co., Ld	27
Davey, Paxman & Co., Ld.	52
Davidson & Co., Ld	71
Davie & Horne	93
Davies & Metcalfe, Ld.	78
Davies, T., & Son	66
Davy Bros., Ld	70
Dawson & Downie, Ld	60
De Bergue & Co., Ld	44
Delta Metal Co., Ld	100
Demag, Duisburg	3
Denison, S., & Son, Ld	93
Douglas Lawson & Co	66
Drake & Gorham, Ld	88
Drewry Car Co., Ld	45
Drum Engineering Co.	6
Drysdale & Co., Ld	80
Duris, Bourne & Co., Ld	90
East Ferry-road Engin'ng Co	22
Easton & Anderson	63
Eclipse Tool Co	94
Electric Control Limited	6
Ellison, G.	44
Emmin Engineering Co	6
Engineers' Club	6
Ewart Chainbelt Co., Ld	102
Fairbanks, Morse & Co., Ld	87
Felten & Guilleaume Carlswerk A.G.	59
Ferguson Brothers, Ld	7
Ferodo, Limited	87
Ferranti Ld	66
Fielding & Platt, Ld	74
Filma Oil Burners, Ld	88
Findlay, A., & Co., Ld	90
Firth, T., & Sons, Ld	21
Foster, J., & Sons	85
Four Wheel Drive Lorry Co., Ld	23
Fraser & Chalmers Engineering Works	97
Fraser, D., & Sons, Ld	64
Fry's Metal Foundries, Ld	59
Fuller, Horsey, Sons & Cassell	102
Fullerton, Hodgart & Barclay, Ld	72
Gardner, L., & Sons, Ld	5
Gaywoods Bronze Co.	3
General Electric Co., Ld	97
Gibbins, R. C., & Co	6
Glasgow Railway Eng. Co	53
Glenfield & Kennedy, Ld	22
Glenifer Motors, Limited	90
Goodall, Clayton & Co., Ld	83
Goodwin Barsby & Co	62
Grafton & Co	91
Grantham Boiler & Crank Co	6
Graphite Products, Ld	6
Green & Boulding, Ld.	22
Greenwood's GearCutting Co	22
Gresham & Craven, Ld	78-95
Grieve, J., & Co	44
Gunther, W., & Sons	100
Gwynnes Pumps, Ld	28
Hadfields, Limited	52
Hall, B. J., & Co., Ld	97
Hall, J. & K., Ld	56
Hamworthy Engineering Co	62
Harpers Limited	102
Harris & Mills	53
Hartley Sons & Co	45
Hart, T., Ld	92
Haslam F'dry & Eng. Co., Ld	76
Hawthorn, Leslie & Co	102
Head, Wrightson & Co., Ld	72
Heap, J., & Co., Ld	60
Heathman	44
Hostly-Gresham Eng'g Co.	4
Henderson, J. M., Co., Ld	95
Hendry, J.	61
Henschel Locomotives	85
Herbert, A., Ld	3-12-13
Higgs Motors	90
Hill & Smith, Ld	80
Hobdell, Way & Co., Ld	93
Holden & Brooke Ld	3-63
Hollings & Guest, Ld	43
Holroyd, J. & Co., Ld.	62
Horderu, Mason & Edwards Ld	95
Horne Engineering Co	62
Hovle, J., & Sons, Ld.	61
Hudson, R., Ld	49
Hudswell, Clarke & Co	79
Hull Forge Iron & Steel Co	83
Hulse & Co., Ld	53
Hurst, Nelson & Co., Ld	53
Hydraulik, G.m.b.H.	63
Incandescent Heat Co. Ld	43
Ince Forge Co., Ld	102
Ingersoll-Rand Co., Ld	98
Ingtis, G., & Co. Ld	82
Independent Pneumatic Tool Co.	7
International Combustion Ld	53
Iron Foundry Co., Ld	81
Jackman, J. W., & Co., Ld	44
Jenkins Bros., Ld.	62
Johnson, W. F., & Co	22
Jones & Lamson Machine Co	5
Kasenit, Ld	59
Kaye, J., & Sons, Ld	6
Kearns, H. W., & Co., Ld	76
Keith & Blackman Co., Ld	61
Kirk, Price & Co	2-102
Laidlaw, Drew & Co	66
Lake & Elliot, Ld.	102
Langham Engineering Co	45
Lancaster & Tonge, Ld	95
Lang, John, & Sons, Ld	14
Latona Engineering Co., Ld	22
Leathers Co., Ld	101
Ledward & Beckett, Ld	53
Leeds Eng. & Hydraulic Co	93
Lees, T. & R., Ld.	44
Leroy, F., & Co	95
Ley's Malleable Castings Co	102
Littlejacs Eng. Co., Ld	6
Liverpool Refrigeration Co	44
Llewellins Machine Co	100
Lobnitz & Co., Ld	93
London Hoist Co	91
Lunken Co., Ld	58
Macfarlane Engineering Co	82
Macmillan, F. & W.	53
Maffei, J. A.	92
Manchester Furnaces, Ld.	48
Manning, Wardle & Co., Ld	60
Marshall, Sons & Co., Ld	30
Mechans Limited	82
Meldrums Ld.	64
Mepstead & Co	12
Mercer, E.	53
Merryweather & Sons, Ld.	22
Metallic Seamless Tube Co	91
Metropolitan-Vickers Electrical Co., Ld	43
McNeil, C., Ld	61
Michell Bearings, Ld	64
Miller, W., & Sons, Ld	53
Mirrless, Bickerton & Day	68
Mirrless Watson Co., Ld	68
Mitchell Conveyor & Transporter Co., Ld	92
Morgan, W., & Co., Ld	87
Morton & Weaver	63
Motherwell Bridge Co., Ld	63
Mumford, A. G., Ld	88
Musgrave Bros.	101
Musgrave & Co., Ld	57
National Gas Engine Co., Ld	82
Neal, R. H., & Co., Ld	45
Negretti & Zambra	91
Newall, A. P., & Co., Ld	83
New Alldays & Onions, Ld	67
New Conveyor Co., Ld	56
Newton Sales Co., Ld	22
Oakey, J., & Sons, Ld.	53
Oerlikon Limited	75
Orr, Watt & Co., Ld.	82
Parkinson, F. & A., Ld	30
Parsons, C. A., & Co., Ld	16
Patent Lightning Crusher Co	78
Paterson Engineering Co., Ld	52
Paterson Hughes Engineering Co., Ld.	89
Pearn, F., & Co., Ld	89
Pearson, N., & Co., Ld	24
Peckett & Sons, Ld	30
Peebles (Bruce) & Co., Ld.	19
Pegler Bros. & Co., Ld	82
Peterson, Snell & Co. (Glasgow)	10
Phillips, J. W. & C. J.	8
Piggott, T., & Co., Ld.	5
Platt, Isaiah, Ld	82
Plenty & Son, Ld	85
Potter, A. C., & Co	3
Power Gas Corporation, Ld	64
Power Plant Co., Ld	90
Premier Cooler & Engineering Co., Ld	65
Premier Gas EngineCo., Ld	29
Priestman Bros., Ld	6
Pullen, F. A., & Co., Ld	85
Pulsometer Engineering Co	6
Radford, Son & Squire	102
Ransome, A., & Co., Ld	102
Reavell & Co., Ld.	73
Reddaway, F., & Co., Ld	99
Redman, C., & Sons, Ld	71
Revoirs, G., Ld	53
Rheinmetall, Duesseldorf	90
Rice & Co., Ld.	100
Richards, G., & Co., Ld	15
Richards R., & Co.	102
Ringhoffer - Koprivnice Studenka	60
Richardsons, Westgarth & Co	87
Ritchie-Atlas Eng'g. Co	83
Roboy & Co., Ld	50
Rogerson, J., & Co., Ld	82
Ropeways Limited	45
Rose, Downs & Thompson	63
Ross, R. G., & Son, Ld	94
Royce, Ld	73
Royles, Ld	53
Rushworth Bros. Ld	66
Russell, Geo., & Co., Ld.	102
Rustoa & Hornsby, Ld	17
Schlesmann A.G.	84
Scriven & Co. (Leeds), Ld	64
Selson Engineering Co., Ld	100
Sentinel Waggon Works, Ld	56
Shaaks, A., & Sons, Ld	89
Shipping Exhibition	67
Siebe, Gorman & Co., Ld	90
Siemens-Schuckert (Great Britain) Ld	5
Sillimanite, P. B., Co., Ld	91
Simon, H., Ld	62
Simons, W., & Co., Ld	7
Smedley Brothers, Ld	91
Smidth, F. L. & Co., Ld	46
Smith, Barker & Wilson	80
Smith Bros. & Co. (Glasgow)	10
Smith Bros. & Co. (Hyson), Ld	93
Smith & Grace, Ld	85
Smith, John (Keighley), Ld	96
Smith, T., & Sons (Rodley)	60
Smith, T., & Sons (Saltley), Ld	91
Smooth-On Mfg. Co	61
Snuilders, A. F.	39-83
Soc. Editrice Unitas	96
Societa Italiana Ernesto Breda	92
Spencer (Melksham) Ld	43
Spon, E. & F. N.	6
Standard Piston RingCo., Ld	92
Ste[illegible] W. F., & Co., Ld	86
Ste[illegible] Cowlishaw	41
Ste[illegible]rol Co., Ld	38
Ste[illegible]pany of Scotland	93
Ste[illegible] Co., Ld	94
Ste[illegible]n, R., & Co., Ld.	60
Ste[illegible] Sons, Ld.	64
Ste[illegible]er Co., Ld	77
S[illegible] & Co., Ld	93
S[illegible] Ld	77
[illegible]neering Co	11
[illegible]	82
Sulzer Bros.	47
Summerson, T., & Son, Ld.	53
Sutcliffe Bros. & Bryce	44
Swain, John, & Son, Ld.	53
Tangyes Limited	9
Taylor, C. (Birm'ham), Ld.	45
Taylor & Challen, Ld	18
Tecalemit, Limited	64
Tees Side Bridge & Eng'g Co	63
Tennent, R. B., & Co., Ld.	60
Terry H., & Sons, Ld.	58
Thomas & Bishop	62
Thomson, J. (Sheffield), Ld	102
Thomson, W., & Co., Ld	6
Thornycroft, J. I., & Co., Ld	10
Thor Pneumatic & Electric Tool Co., Ld	7
Tighman's Patent Sand Blast Co., Ld	84
Trier Bros., Ld.	92
Tullis, J., & Son, Ld	74
Turbine Furnace Co., Ld	86
Turbine Gears, Ld	94
Turner, G. R., Ld	53
Turton, T., & Sons, Ld	91
Underfeed Stoker Co., Ld.	52
Urquhart Lindsay & Robertson Orchar, Ld	95
Vacuum Brake Co., Ld	78
Valor Co., Ld	58
Vickers Limited	51
Visco Engineering Co., Ld.	11
Vono Co	81
Wailes, G., & Co	102
Wallwin Co	90
Wallwork, H., & Co., Ld	65
Ward, T. W., Ld	4-87
Weir, G. & J., Ld.	33
Weldless Steel Tube Co., Ld.	88
Wellman Bibby Co., Ld	81
Wells, A. C., & Co	23
Whitecross Co., Ld	82
Widnes Foundry (1925) Ld	58
Wigzins, F., & Sons	92
Wilson Boilermakers Ld	82
Wootton Brothers	82
Worthington-Simpson, Ld.	48
Ward, H. W., & Co., Ld	15
Wright, Anderson & Co., Ld	6
Yarrow & Co., Ld	39-102
Yorkshire Copper Works, Ld	101
Young	50
Zwicky Ld	56

"Yorkshire" TUBES in COPPER BRASS CUPRO-NICKEL

In 85/15, 80/20, 70/30 mixtures.

In all Sizes For all Purposes.



The Prevention of Corrosion-Erosion.

Research in our Laboratories has made it quite clear that this type of trouble is due to entangled air, and gases in the cooling water.

We can advise you how to obviate or get rid of this trouble; in the meantime "Yorkshire" Tubes are the best palliative, and where the trouble is severe, "Yorkshire" Cupro-Nickel Tubes are more economical than Brass.

Shipping Companies & Power Stations:

USERS OF CONDENSER PLANT — where corrosion troubles of any kind are experienced, are invited to ask our Research Department for a thorough investigation and report (furnished free and without obligation).

YORKSHIRE COPPER WORKS LTD

Nothing but Tubes

LEEDS, ENGLAND.

Telephones: 20031. *Telegrams:* "TUBES, Leeds."

LONDON OFFICE:—53, New Broad St., E.C.2.

Contractors to British and Foreign Admiralties and all Government Departments.

MUSGRAVE BROS., CROWN POINT FOUNDRY, LEEDS.

FOR SHIPBUILDERS, BOILERMAKERS, STEEL WORKS, BRIDGE BUILDERS, CARRIAGE RAILWAY & WAGON WORKS, etc.

Makers of All Description of HYDRAULIC MACHINERY

THE BRITISH SPECIALISTS. (ON ADMIRALTY WAR DEPT. AND COLONIAL LISTS.)

HYDRAULIC LEATHERS

LEATHERS COMPANY LIMITED ALTRINCHAM.

AUCTIONS

FULLER, HORSEY
SONS AND CASSELL,

ESTABLISHED IN BILLITER SQUARE IN 1807.
11, BILLITER SQUARE, E.C. 3.

MECHANICAL AUCTIONEERS, SURVEYORS AND VALUERS
OF
MILLS AND MANUFACTORIES, ENGINEERING WORKS, &c.
FIRE LOSS ASSESSORS.

NOTE.—A STAFF OF SPECIALISTS attends to the requirements of Manufacturers seeking New Works or Works Sites and a

REGISTER OF VACANT FACTORIES

will be forwarded free on application.

THE THORNLEY BINDERS, Ltd., of Stromness, Orkney.—By Order of GEORGE LORD, Esq., F.C.A., Liquidator.—Messrs.

Fuller, Horsey, Sons and Cassell are inviting TENDERS for the PURC[HASE] in Two Lots of

(A) THE CHEMICAL PLA[NT] AND MACHINERY

at the Stromness Works, including P[lant], by Craig, of Paisley, with W[ater] Dowale Gas Producers, Sturtevant Fan[s], Five Steam-jacketed Mixing and Bo[ilers], Five Ideal Alpine Mills; Motor-dri[ven] extractor; Reavell Air Compressor and [Set], Two Babcock-Wilcox Boilers with Mechanical Stokers; Weir Feed Pumps; Two 750 H.P. Bellis and Morcom Triple-expansion Engines; Motor-driven and other Pumps; Tanks 120 K.W. 230-Volt Generator coupled to a 180 H.P. Bellis and Morcom Engine; a 13 K.W. 230-Volt Generator with Gardner 35 H.P. Petrol-paraffin Engine; a 50 K.W. 230-Volt C.E.C. Generator; Nine Electric Motors, from 2½ to 60 H.P.; Two Leaching Tanks, 45ft. Motor Boat; Five Flat-bottom Punts; Two Store Boats; a 10-Ton Steam Derrick Crane; Ford Saloon, Loose Plant, Laboratory Apparatus and other effects.

(B) THE PLANT AND MACHINERY

at Hurt's-lane, Barking, E., comprising Steam-jacketed Mixers, Alpine Grinding Mills, Steel Receivers, Two Motors and Hydraulic Press, &c.

Form of Tender, which are deliverable on Monday, July 18th, 1927, may be had of Messrs. FULLER, HORSEY and CO., Mechanical Auctioneers and Valuers, 11, Billiter-square, E.C. 3. 5786 J

TO ELECTRICAL ENGINEERS.—By Order of the BARKING TOWN URBAN DISTRICT COUNCIL, who have arranged to purchase their Electric Power instead of generating same.—Messrs.

Fuller, Horsey, Sons and Cassell will offer for SALE by AUCTION, in Lots, at the MERCHANTS' HALL, BALTIC EXCHANGE, E.C., on THURSDAY, JULY 14th, at Three o'clock precisely,

ELECTRICAL POWER PLANT

including a BRUSH-LJUNGSTROM 1000 K.W. TURBO-ALTERNATOR, 6600 volts, 3-phase, 50 periods, with condensing plant, air filter, &c.

A 400 K.W. 460-550-Volt D.C. SET, with Davey-Paxman Triple-expansion Engine, Johnson and Phillips Generator.

A VERTICAL COMPOUND ENGINE, by Allen, coupled to a Siemens 250 K.W. 480-550-Volt D.C. GENERATOR and a Crompton 250 K.W. 3-phase ALTERNATOR, 6600 volts, 50 periods.

TWO 100 K.W. 460-520-Volt D.C. SETS, with Allen Vertical Compound Engine and Thames Electrical Co.'s Generators.

Allen Condensing Set. Four Babcock and Wilcox Boilers, 165 lb. w.p. Two Green's Economisers. Motor-driven and Steam Pumps. Lea Recorder, &c.

May be viewed on production of catalogue, which may be obtained on application to Messrs. FULLER, HORSEY and CO., Mechanical Auctioneers and Valuers, 11, Billiter-square, E.C. 3. 5787 J

QUEEN MARY RESERVOIR, ASHFORD, MIDDLESEX.

To be SOLD by Order of the METROPOLITAN WATER BOARD on completion of the works.—Messrs.

Fuller, Horsey, Sons and Cassell will SELL by AUCTION, in Lots, at the MERCHANTS' HALL, BALTIC EXCHANGE, ST. MARY AXE, E.C. 3, on THURSDAY, JULY 14th, 1927, at Eleven o'clock precisely,

CONTRACTORS' PLANT AND MACHINERY,

including THREE 14in. STEAM LOCOS., by Peckett and Barclay; ONE 10 Ton and ONE 5-Ton

CONTINUED IN NEXT COLUMN

TRADE **SUMMIT** MARK
SLITTING
SAWS
AND
Screw Slotting Cutters.
JOSEPH THOMPSON (Sheffield), LTD.,
TOWNHEAD STREET ENGINEERING WORKS, SHEFFIELD.

YARROW,
GLASGOW.
LAND BOILERS
FOR
ELECTRIC POWER STATIONS AND FACTORIES.

FOUR IMPORTANT BOOKS

HANDBOOK OF ORE DRESSING

By ARTHUR F. TAGGART and Seven Contributors. 1579 pages, illustrated. Flexible binding. 50s. net. The art of ore dressing has advanced with gigantic strides during the past twenty years, chiefly by reason of the introduction of sulphide-ore slimes, by the use of ball mills and the like for fine grinding. The literature on the subject, however, has not kept pace with the advance in knowledge, and this fact makes the publication of Taggart's IMPRESSIVE ENCYCLOPÆDIC WORK singularly timely. Its preparation covers a period of over 10 years and is the result of much research, experience, and consultation with experts in the field.

HYDRO-ELECTRIC HANDBOOK

By WILLIAM P. CREAGER and J. D. JUSTIN and a Staff of Nine Specialists. 879 pages, 494 figures, 92 tables and 5 folding charts. Demy 8vo, 40s. net. A complete working treatise on current practice—no subject is mentioned without carrying it to a complete conclusion with positive recommendations. The last word on latest developments and approved modern methods.

THE METALLURGIST'S MANUAL

By T. G. BAMFORD, M.Sc., and HAROLD HARRIS, M.Sc., F.C.S. With a Foreword by Thomas Turner, M.Sc., A.R.S.M., F.I.C., Emeritus Professor of Metallurgy, University of Birmingham. Demy 8vo, 15s. net.

THE METALLURGIST'S MANUAL is intended for the use of Metallurgists in all parts of the world, of Metallurgical Students at Universities and Technical Schools, of Engineers, and of others interested in metals. It is believed that it will form a useful book for refreshing the memories of even skilled men upon many points which arise in the conduct of industry.

THE WORKING OF ALUMINIUM

By EDGAR T. PAINTON, B.Sc. (Eng.), Hon. M. Inst. Met. 223 pages, Demy 8vo, 15s. 6d. net. Ready next week. Sets forth the principles which should be followed in order to obtain the best results with aluminium in all branches of metal working.

Prospectuses E.11 free on request.

CHAPMAN & HALL, LTD., 11, HENRIETTA STREET, LONDON, W.C. 2.

AUCTIONS

Fuller, Horsey & Co.'s Advertisements

Continued from previous column.

LOCO. STEAM CRANES, by Wilson: 1000 TONS STEEL RAILS (60 lb. and 75 lb.); 100 4½-Yard SIDE-TIP WAGONS, 20 Ballast Trucks, 7500 Sleepers, 840 Yards 24in. Decauville Track, 20 24in. gauge Side-tip Wagons, THREE Winget CONCRETE MIXERS (3 cu. ft. capacity) with Motors, SIX Winget BLOCK-MAKING MACHINES and 6600 Pallets, THREE STOTHERT and PITT CONCRETE MIXERS with 5 H.P. Lister Engines, ½-Yard Chalmers CONCRETE MIXER, Three Pug Mills, 250 TONS INTERLOCKING STEEL FILING (15in. by 5in.), 30,000 FEET STEEL PIPING up to 5in., 13 Centrifugal Pumps, 1280 H.P. NATIONAL GAS ENGINE and Three 100 H.P. Gas Engines, all with producer plants.

FIVE D.C. GENERATORS (65 and 85 K.W., 460-550 volts).

Nine D.C. Motors up to 40 H.P., 21-Ton POOLEY RAILWAY WAGON WEIGHBRIDGE, 3-Ton THREE-MOTOR OVERHEAD TRAVELLER, 35ft. span.

ENGINEERS' MACHINE TOOLS, including 13in. by 14ft. Redman Lathe, 16in. Atlas Shaper, 42in. Radial Drill, Vertical Drilling Machines, Pipe Screwing Machines, Hack Saw Machine, Hydraulic Wheel Press, Power Rail, Straightening Press, Chain Mortising Machine, 36in. Band Saw, 24in. Circular Saw Bench, Grabs, Skips, Lifting Tackle, Vices, Air Compressors, Portable Weighing Machines and other effects.

IMPORTANT NOTICE.—The Vendors will LOAD ALL LOTS FREE OF CHARGE into purchasers' wagons or lorries.

May be viewed on production of catalogue, to be had of Messrs. FULLER, HORSEY, SONS and CASSELL, Mechanical Auctioneers and Valuers, 11, Billiter-square, E.C. 3. 5788 J

Field and Sons will SELL at the LONDON AUCTION MART, on TUESDAY, 5th JULY, at 2.30, in Two or Four Lots,

BERMONDSEY—186 and 188 LONG-LANE,

FREEHOLD PROPERTY,

Comprising Engineer's Workshops and Open Yard, affording 8800 super feet, with Manager's House, both with VACANT POSSESSION. Also the adjoining TEN FREEHOLD DWELLING-HOUSES (four with shops), 190 to 196, Long-lane, and 5-10, Baffin's-place. Gross rents £498 16s.

Particulars of Messrs. Alpe and Ward, Solicitors, 1, Mitre Court-buildings, Temple, E.C. 4; Mr. A. Fitzsimmons, F.S.I., 28, Garthorne-road, Honor Oak-road, S.E. 23; and Messrs. FIELD and SONS, 54, Borough High-street, London Bridge, S.E. 1. Telephones, Hop 1375 and 1376. 5728 J

TOPLOCKS NURSERY, SOUTHALL.

About 15 minutes' walk of Southall Station, G.W.Ry.

VALUABLE FREEHOLD LAND,

Covering an area of about 26 ACRES, with frontages to Grand Junction Canal and Glade-lane, and suitable for the

ERECTION of FACTORIES or DEVELOPMENT as a BUILDING ESTATE.

Included in the Sale are Seven Modern Cottages, Farm-house and Outbuildings

Leopold Farmer and Sons in conjunction with **Waterer and Sons,** will SELL the above by AUCTION, in Lots, at the MART, 155, QUEEN VICTORIA-STREET, E.C. 4, on WEDNESDAY, 29th JUNE.

Particulars, plan and conditions of sale may be obtained of Messrs. WATERER and SONS, Estate Agents, Werbridge, Surrey; and the AUCTIONEERS, 46, Gresham-street, Bank, E.C. 2, and Kilburn, N.W. 6. 5702 J

For continuation of Auctions see Page 3.

BUSINESSES and PREMISES
(For Sale, etc.).

IDEAL FACTORY PREMISES, N. London. Own power and light trifling cost, eminently suitable engineering; 6000ft. floor space covered, ample extension room; magnificent site. FREEHOLD £4000, including new 35 H.P. Crude Oil Engine, Dynamo, Shafting, &c.—Address, P3337, The Engineer Office. P3337 L

FOR SALE, THEODOLITES, DRAWING INSTRUMENTS, SECOND-HAND, CLARKSON'S, 338, High Holborn, W.C. (Opposite Gray's Inn-road).

FOR SALE, LEVELS, DRAWING INSTRUMENTS, SECOND-HAND, CLARKSON'S, 338, High Holborn, W.C. (Opposite Gray's Inn-road). Ex.

AUCTIONS

HENRY BUTCHER, HALL & CO.
AUCTIONEERS, SURVEYORS & VALUERS.
SPECIALISING IN THE SALE AND VALUATION OF
FACTORIES, PLANT AND MACHINERY.
RATING SURVEYORS, FIRE LOSS ASSESSORS.
63 & 64, CHANCERY LANE, LONDON, W.C. 2.

By Order of the Receivers, re Thomas Heritage and Co., Limited.—Messrs.

Henry Butcher, Hall and Co. will SELL by AUCTION, on the Premises, BURWELL-ROAD, LEA BRIDGE-ROAD, LEYTON, E. 10, on WEDNESDAY, 6th JULY, 1927, at 11 a.m., the

PLANT, MACHINERY, AND STOCK

of a

BUTTON MANUFACTURER,

Comprising about 150 Automatic Button Polishing, Drilling, Disc Cutting, Turning, Milling, Ball Drilling, Grinding, Edging and other Machines, by Messrs. Sylbe and Pondorf.

ENGINEERS' MACHINE TOOLS, including S.S. and S.C. Lathes, Bench Drilling and Shaping, Grinding, Finishing, Hack Saw and other Machines, Screw Fly Presses, Toggle Presses, Electric Motors, National Time Recorder, Vices, Pulleys, Belting, &c.

STOCK AND STORES.

Rod, Tube and Sheet Erinoid, Cardboard Boxes and Finished Buttons.

Catalogues (when ready) may be obtained from Messrs. Crew, Turnbull and Co., Chartered Accountants, 4, Dowgate, Old Jewry, London, E.C. 2, and George-street West, Luton; Messrs. J. R. Woodley, Morgan and Co., Incorporated Accountants, 34, Gresham-street, London, E.C. 2; or Messrs. HENRY BUTCHER, HALL and CO.

R. Heber Radford, Son & Squire,
ENGINEERING IRON AND STEEL WORKS VALUERS
CONSULTING ENGINEERS, REFEREES AND ARBITRATORS.
Established over 50 years.
15, ST. JAMES' ROW, SHEFFIELD.
Telegrams, Radford, Sheffield. Telephone 429.

Cranes.—Electric, Steam.
HYDRAULIC AND HAND,
of all types and sizes.
GEORGE RUSSELL AND CO., LTD.,
Motherwell, near Glasgow. Spl 88 17

A. RANSOME & Co. Ld., NEWARK
CASTINGS
OF EVERY DESCRIPTION.
See Displayed Advt. last and next week

FOR HIRE

APPLY to RICHD. B. BATCHELOR, ARTESIAN WELL & CONSULTING ENGINEER (WATER SUPPLIES EXPERT).
All equipments for improving your Water Supply. Largest Well Boring Plant, 3in. to 9ft. diam. Every description of Pumping Plant.
73, Queen Victoria-st., E.C. 4; & Chatham.
'Phones: Central 4904; Chatham 71.
Wires: Boreholes, London; Watershed, Chatham.
ESTAB. OVER 150 YEARS.

FOR SALE or HIRE, ELECTRIC MOTORS, from ¼ to 300 H.P.; PORTABLE STEAM ENGINES, from 8 to 40 N.H.P.; STEAM BOILERS, CRANES, PUMPS, MACHINE TOOLS of every description; reasonable terms, immediate delivery.—J. T. WILLIAMS and SONS, 37, Queen Victoria-street, London, E.C. Tel., City 3938. Ex.

FOR HIRE, PUMPS and WELL-BORING TOOLS for Trial Borings and Deep Wells.—R. RICHARDS and CO., Upper Ground-street, London, S.E. Telephone No. 0975 Hop. 522 K

AUCTIONS

ESTABLISHED OVER 75 YEARS.

WHEATLEY KIRK, PRICE & Co.
SPECIALIZE IN
VALUATIONS
AND
SALES BY AUCTION
OF
ENGINEERING WORKS, PLANT & MACHINERY
OF
EVERY KIND.
LONDON: 46, WATLING STREET, E.C. 4.
MANCHESTER: 16, ALBERT SQUARE.
NEWCASTLE-ON-TYNE: 25, COLLINGWOOD ST.

CAMMELL LAIRD & CO., Ltd
SHEFFIELD & BIRKENHEAD,
Steel Manufacturers, Shipbuilders, Engineers.
London Office:
9, CENTRAL BUILDINGS, WESTMINSTER, S.W.
See last week's and next week's advertisement.

CAMPBELLS & HUNTER, LD.
SPECIALISTS IN
DRILLING AND BORING MACHINERY
For Engine Works and Boiler Shops.
DOLPHIN FOUNDRY, LEEDS.

FOR ELEVATORS AND CONVEYORS, ALSO MALLEABLE IRON CHAINS,
APPLY
EWART CHAINBELT CO., LTD.,
DERBY, ENGLAND,
being an amalgamation of the Chain Belt Engineering Co. and Ewart's Chain Mfg. Co., Derby, England.

"BLACK HEART"
(REGD. TRADE MARK.)
MALLEABLE CASTINGS
FOR ALL PURPOSES.
SOLE MAKERS:
LEY'S MALLEABLE CASTINGS CO., Ltd.
Vulcan Ironworks, DERBY.

HARPERS LIMITED.
See page 32 last week.

INCE FORGE Co., Ld., WIGAN
Hammered or Hydraulic Pressed
FORGINGS
in Iron or Steel, Black or Machined, to 20 Tons.

MILLENNIUM STEEL CASTINGS
MADE FROM THE ELECTRIC FURNACE.
LAKE & ELLIOT Ltd.
BRAINTREE - - ENGLAND.

BAXTER'S KNAPPING-MOTION
STONE BREAKERS
ARE 50% MORE VALUE.
W. H. BAXTER, Ld., LEEDS.

TANK LOCOMOTIVES.
SPECIFICATION and WORKMANSHIP EQUAL TO MAIN LINE LOCOMOTIVES.
R. and W. HAWTHORN, LESLIE and CO., Ltd.,
NEWCASTLE-ON-TYNE

GEORGE WAILES & CO.,
ENGINEERS, MILLWRIGHTS AND FOUNDERS,
Are prepared to undertake the manufacture of
ALL CLASSES of SPECIAL MACHINERY,
either to Patents Specification or Drawings.
Also the designing of any invention of speciality, and pattern making,
under the personal supervision of the patentee.
MACHINE WORK OF EVERY DESCRIPTION FOR THE TRADE.
Speciality: MACHINE CUT GEARS.
Reducing gears for all powers.
Transmission Fittings of every description.
GEORGE WAILES & CO.,
386-8, Euston Road, N.W. 1.
We invite you to inspect our new department for the sale of ENGINEERS' NEW & SECOND-HAND MACHINES & TOOLS.

Printed for the Proprietors by GEORGE REVEIRS, LIMITED, at Greystoke-place, Fetter-lane, London, and published weekly by ARTHUR RONALD VAUGHAN at THE ENGINEER Office, 33, Norfolk-st., Strand, in the Parish of St. Clement Danes, in the County of Middlesex.